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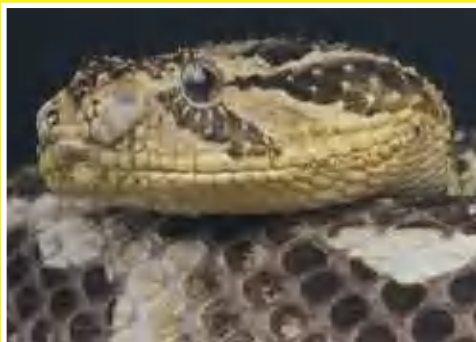
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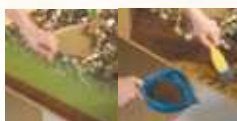




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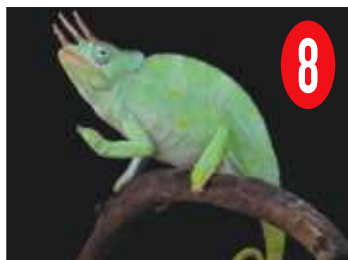
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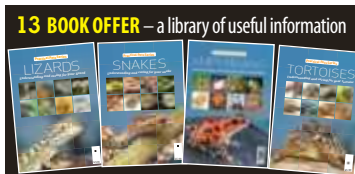
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One of the most interesting aspects of the hobby is simply observing the behaviour of the animals in your care. In many cases, this can be potentially ground-breaking. You could well be the first person to take time to note particular behaviours, especially in some of the more unusual species. Nowhere is this more evident, of course, than when it comes to breeding behaviour.

It is always exciting to breed a new species for the first time, but particularly so if breeding results have not been documented before. Here is a blueprint that can guide fellow enthusiasts working with that species in future, and even partial successes can add significantly to our knowledge in this area.

I'm really keen to publish accounts of this type, and help to make information of this type more widely available. I'm therefore particularly pleased to be able to include in this issue an account of what seems to be not just the first breeding of the Madagascan plated lizard (*Zonosaurus madagascariensis*), but possibly the first of any member of this genus in vivarium surroundings.

Many readers will know John Courteney-Smith of Arcadia Reptile as a pioneering herpetologist, who has driven forward the levels of equipment available to those keeping reptiles and amphibians. He has always argued passionately for "Wild Re-creation" – match the environmental parameters of species in the wild, and it should follow that they will ultimately start to breed in due course in vivarium surroundings.

His success with the Madagascan plated lizard confirms this theory. In the absence of any information about the reproductive behaviour of this species, John relied on environmental data to create a set-up that he hoped would replicate their native habitat, and lead to these lizards breeding successfully.

If you have had success with a rarely bred species, please do get in touch and let us know. We can help you to share your experiences with fellow enthusiasts, hopefully increasing the number of successful breedings taking place each year, as well as adding overall to our knowledge about this fascinating group of creatures.

David Alderton

David Alderton, Editor.  
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David has extensive practical experience with this group of creatures, going back over 40 years. He has written and broadcast widely about their care and biology, and his website can be found at [www.petinclub.com](http://www.petinclub.com)

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# More fishing snakes found

**T**hree new species of fishing snake, belonging to the *Synopsis* genus, have been found in the Andean cloud forests of Amazonian Ecuador and Peru, in western South America. Not only is the discovery remarkable on the basis of the number of new species identified, but also because it is the first time that a member of this genus has been recorded from Peru.

The three new species have been identified as a result of both field and laboratory work, undertaken by Dr. Omar Torres-Carvajal, from the Museo de Zoología QCAZ, Ecuador, in collaboration with herpetologists from Peru and the United States. The new species differ from their closest relatives in terms of their scale features, the structure of the males' hemipenes (sexual organs) and their DNA.

## Don't trust the name!

Although they are commonly known as fishing snakes, these reptiles most likely do not eat fish! At present, however, their diet and behaviour are poorly known. So far, it has only been reported that one species feeds on lizards.

Fishing snakes have long been known to live in cloud forests on both sides of the Andes of Colombia and Ecuador. Yet it seems the number of species has been dramatically underestimated. The new discoveries documented here, along with a recent description of another from southwestern Ecuador has doubled the number of known species of fishing snake from four to eight within just a few months.

During their recent expeditions to



A live individual of *Synopsis insulomontanus*, one of the three new species of fishing snake discovered in the Andes of Ecuador and Peru. Photo courtesy Germán Chávez.



▲ The newly-discovered *Synopsis bogerti*. Photo courtesy Omar Torres-Carvajal.

▼ The Amazonian cloudforest habitat where these snakes are to be found.

various localities along the Andes of Ecuador and Peru, the authors collected several individuals of fishing snakes, which they suspected to be previously unknown. After comparing their specimens with those deposited in a number of natural history museums, the authors' suspicions became stronger, and have now been confirmed – these are new species.

## The significance of these finds

"We started working with fishing snakes a year ago as new specimens were being collected in poorly explored areas on the Amazonian slopes of the Andes in Ecuador and Peru," explains lead author Dr. Omar Torres-Carvajal. "At that time, only four species of fishing snake had been described, and they were recognised in the literature as one of the most rare and secretive groups of snakes in South America."

"In less than a year, we and other herpetologists have doubled the number of known species of fishing snake, showing that their diversity had been

greatly underestimated," he adds.

"This story is similar to that of the wood lizards (*Enyalioides* species), a group of dragon-like lizards with more than half of the species now recognised having been found in recent years in the tropical Andes."

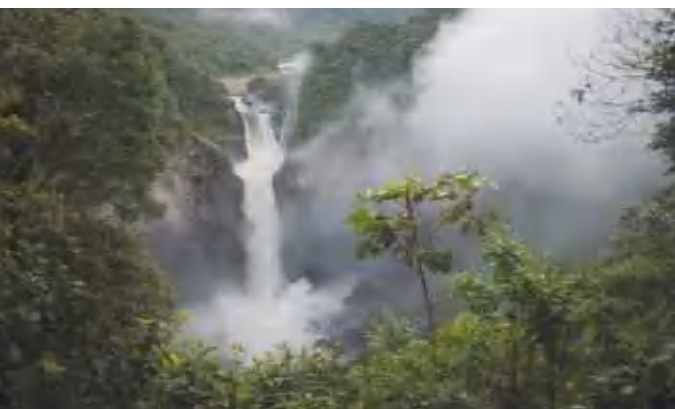
"These discoveries indicate that this hotspot is more diverse than we thought, so it is very important that basic biodiversity research is properly funded," Dr. Torres-Carvajal concludes. "Otherwise, we might never know what other scaly creatures are crawling around us, as they could vanish before we are aware that they even existed."



This species is now known to science as *Synopsis zamora*. Photo courtesy Omar Torres-Carvajal.

## Further information

Torres-Carvajal O, Echevarría LY, Venegas PJ, Chávez G, Camper JD (2015) Description and phylogeny of three new species of *Synopsis* (Colubridae, Dipsadinae) from the tropical Andes in Ecuador and Peru. *ZooKeys* 546: 153-179. doi: 10.3897/zookeys.546.6533.



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# New giant bent-toed geckos discovered in New Guinea

The extremely complex geological history of New Guinea has allowed many of its animals and plants the chance to evolve into different and often striking forms. In the case of these two newly described and unusually large gecko species, only a noble name would do! These impressive lizards were discovered by a team led by Dr. Paul Oliver from the Australian National University and the University of Melbourne.

Both these new discoveries belong to the world's most diverse gecko genus, *Cyrtodactylus*, which comprises more than 200 recognised species to date. These reptiles are commonly called bent-toed or bow-fingered geckos because of their distinctive slender curved toes. They occur through Asia and Australia.

Members of this genus vary greatly in size, build and colouration. However, one of the newly described species, called *Cyrtodactylus rex*, meaning "king" in Latin, is the largest known member of its genus, and ranks amongst the biggest of all geckos in the world.

In general, the bent-toed geckos measure no more than 13cm (5in) in length, yet the king gecko can grow up to 17cm (7in), with females being slightly bigger than males in this case. This species is also characterised by having the upper side of its body covered in alternating



▲ The island of New Guinea lies to the north of Australia. It is shown here from space, illuminated by moonlight.

areas of dark grey brown and medium brown colouration. These are also variable in size and shape, and help to allow individuals to be recognised. All the specimens examined to date are reported to have either four or five dark brown blotches or bands normally running down their tails.

The second new species also bears a noble name – *Cyrtodactylus equestris*, meaning 'knight' in Latin. It is another relative giant among its relatives, attaining a length of up to 14cm (5.5in) in the case of females. Similar in physique to its larger relative, the knight gecko's head is large

and wide, and clearly distinct from the neck.

Its upper side is coloured with alternating regions of light and medium brown. In younger individuals, the patches are visibly defined with dark brown edging, but this delineation is missing in more mature specimens, giving a slightly faded appearance to their patterning.

As a whole, the distribution of these two new gecko species overlaps, although the knight gecko is reported to prefer the relatively undisturbed hill or lower montane (mountainous) forests of northern New Guinea, whereas the king gecko appears to favour the surrounding lowlands.

While the larger size of the New Guinea bent-toed geckos seems to be an evolutionary trend, the role of potential factors such as competition, ecological diversification, isolation and dispersal in shaping these species still remains a mystery.



## Further information

Oliver P.M., Richards S.J., Mumpuni, Rösler H. (2016) The Knight and the King: two new species of giant bent-toed gecko (*Cyrtodactylus*, *Gekkonidae*, *Squamata*) from northern New Guinea, with comments on endemism in the North Papuan Mountains. *ZooKeys* 562: 105-130. doi: 10.3897/zookeys.562.6052

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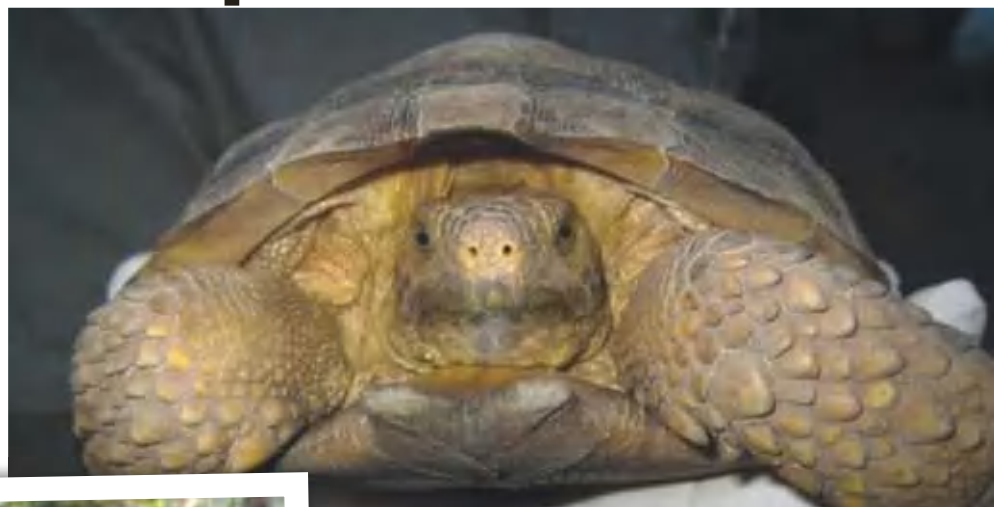
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## New tortoise species confirmed

**T**he huge variability among the desert tortoise populations of Mexico has finally been explained after several decades of confusion. The puzzle was solved by an international team of researchers, led by Dr. Taylor Edwards from the University of Arizona, who teamed up to find out whether there has been a previously unknown third species present in the region throughout this period. Finally, unlike previous investigations, Edwards and his colleagues have managed to provide enough evidence to prove its existence.

Distributed over a large area stretching from the Mojave and Colorado deserts in the United States to mainland Mexico, the tortoise populations in this region were noticed to vary distinctly in appearance as long ago as 1945, when scientists pointed out that the southern populations were suspiciously different. However, due to a lack of enough samples and research, there was insufficient evidence to prove whether there were in fact two separate species here.

Over a period of six years, Dr. Edwards and his team measured a multitude of tortoises during their field trips in Sonora and northern Sinaloa. This enabled them to conclude that the southern populations can be separated on the basis of their significantly shorter tails and flatter carapaces. In addition, unlike its sister species, whose shell is medium to dark brown with greenish hues, while the body is dark gray to brownish-gray, the



▲ The difference in colouration is very apparent, with the newly discovered Goode's gopher tortoise being paler in appearance, as seen here, in comparison with its darker relative.



▼ A short tail and a different carapace shape delineate the new species.

new species of tortoise is dark tan to medium-brownish with an orange cast.

### Lifestyle

It is found exclusively in thorn scrub and tropical broadleaf forests, which is the reason why out of the three species in this region, it has the smallest geographic range, extending over approximately 24,000sq km (9500sq ml).

The new species, called *Gopherus evgoodei*, is named after Eric V. Goode, a conservationist, naturalist, and founder of the Turtle Conservancy. Although there is not much information about their behaviour, it is presumed that the activity of these tortoises is strongly correlated

with the monsoonal rains and the resulting growth of vegetation.

The biologists have observed that the adults begin their seasonal activity in June, shortly before the monsoons and the emergence of new plant growth. Then, in December, the tortoises retreat underground into their dens, where they will spend the dry, cool winter season.

### Further information

Edwards T, Karl AE, Vaughn M, Rosen PC, Torres CM, Murphy RW (2016) The desert tortoise trichotomy: Mexico hosts a third, new sister-species of tortoise in the *Gopherus morafkai*-*G. agassizii* group. ZooKeys 562: 131-158. doi: 10.3897/zookeys.562.6124



Typical tortoise habitat.

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# It's looking better for Ethiopia's banana frog!

**M**ore than 97% of Ethiopia's forests have already been lost, taking a host of species to the brink of extinction or beyond. The banana frog (*Afrixalus clarkei*) is clinging on, with two known populations present in the remaining areas of forest in the south-west of the country.

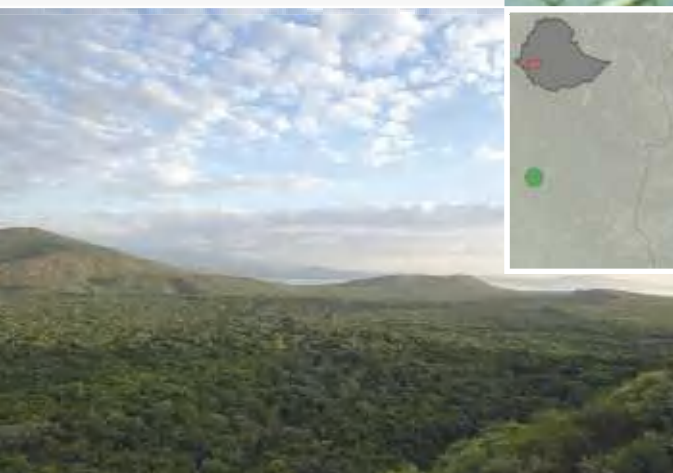
However, a recent survey by a team led by Matthias De Beenhouwer of the Belgian-based organisation called the Biodiversity Inventory for Nature Conservation (BINCO) has revealed that this species actually enjoys a wider range than previously suspected.

Many plant and animal species are endemic to Ethiopia, being found nowhere else in the world, and this includes 41% of the amphibian population. Very few field studies have been carried out, however, and hotspots of biodiversity, where conservation

Photographs courtesy J. Mertens.



◀ Distribution map of the banana frog (*Afrixalus clarkei*). Green polygons represent previously known distribution. Red triangles represent new records. Source: . *ZooKeys* 565: 141–146. doi: 10.3897/zookeys.565.7114



efforts need to be targeted, are unclear.

This new study is therefore important, and was carried out over 10 evenings, involving a total of 111 hours of study, seeking and collecting as many frogs as possible from seven different locations. When the team determined the species status of the frogs that they had found, it turned out that they had managed to discover several new populations of banana frogs from unexpected localities.

▲ Forested areas in Ethiopia are now rare.

As a result of their survey, the geographical range of the Ethiopian banana frog has now been expanded by roughly 40km (25ml) northwards and 70km (43ml) in an easterly direction. In addition, it is clear that the species is found at higher altitudes than previously thought, being found up to 2030 m (6660ft) above sea level, compared to the previously known record of 1800m (6000ft).

The discovery of banana frogs outside primary forest habitats is good news for the species' conservation, since this shows that not only are the frogs more adaptable when faced with forest degradation than expected, but also, there could be even more populations awaiting discovery.

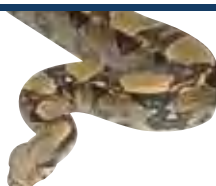


## Further information

Mertens J., Jocu   M., Geeraert L., De Beenhouwer M. (2016) Newly discovered populations of the Ethiopian endemic and endangered *Afrixalus clarkei* Largen, implications for conservation. *ZooKeys* 565: 141–146. doi: 10.3897/zookeys.565.7114

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# A focus on chameleons

A female Usambara three-horned chameleon – only males possess the characteristic horns.

Bill Strand is the host of the Chameleon Breeder Podcast, which offers a free weekly exploration of the world of chameleons, to be found on iTunes or online at [Chameleonbreeder.com](http://Chameleonbreeder.com). He is also the founder of the Dragon Strand caging company for chameleons. Here he speaks to Susie Kearley about his passion for these lizards.

“Chameleons are unique in their appeal and are experiencing a huge growth in popularity at present amongst reptile enthusiasts,” explains Bill, “These beautiful creatures do have a justified reputation for being tricky to maintain

▼ Bill with a friend in his studio.  
Photo courtesy Bill Strand.

though, but with the wealth of information sharing made possible across the internet now, more people are achieving success with these ‘advanced’ level lizards.”

So why did Bill take to the internet with his podcast, and how long has he

been interested in chameleons? “My podcast was born from a passion for chameleons that has spanned decades. I also started ‘Dragon Strand’, a caging company, specifically for the needs of chameleons. I currently keep seven species of chameleon and am actively breeding three of those. I live in southern California, so there’s ample opportunity to utilise outdoor caging methods, even throughout the year with some species.

## Species of interest

Bill’s main focus is on breeding the Natal Midlands dwarf chameleon (*Bradypodion thamnobates*), the Mount Meru Jackson’s chameleon (*Trioceros jacksonii merumontanus*), and the four-horned chameleon (*Trioceros quadricornis quadricornis*). He also keeps the Usambara three-horned chameleon (*Trioceros deremensis*), the western Usambara two-horned chameleon (*Kinyongia multituberculata*), panther chameleons (*Furcifer pardalis*), and a very shy veiled or Yemen chameleon (*Chamaeleo calyptratus*) called Ziggy.

To some people, that may sound like a lot of chameleons, but it is actually a reduction on the range that Bill used to keep! “Chameleons are fascinating and it is easy to get carried away collecting







▲ A male Jackson's chameleon, belonging to the subspecies called *Trioceros jacksonii merumontanus*. This race is sometimes described as the dwarf Jackson's chameleon, to distinguish it from the nominate form – *T.j. jacksoni*.



▲ A four horned chameleon male kept by Bill. Photo courtesy Bill Strand.

species. I have made concerted efforts to focus my chameleon keeping on a select few species to deepen my understanding of them," he says.

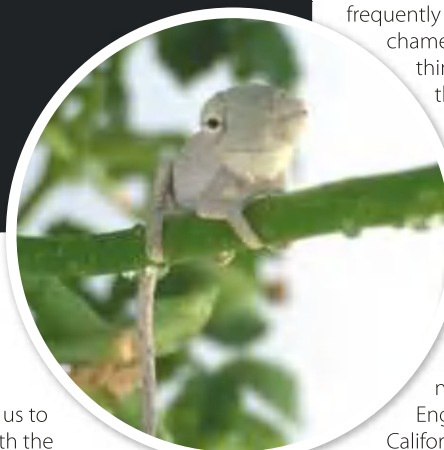
### The appeal and the reality

"Chameleons make appealing pets because they often have bright colours and awesome ornamentation. Their most intriguing characteristic, however, is their ability to change colour. They do not use this ability for camouflage though, but instead, this shift is based on temperature and mood. This means that with a chameleon, you have a reptile that can communicate its

feelings. It literally wears its heart on its sleeve! These communication cues enable us to feel more of a connection with the animal, and that can add significantly to its appeal.

However, they are not the most straightforward lizards to look after, as Bill readily admits. "Unfortunately, they are a challenge for the first time keeper because of their arboreal lifestyle (living in trees), their need to drink water rained down on them rather than from a dish, and their daily husbandry requirements. They are also generally anti-social by nature, and need to be kept on their own!

"There are many good resources on



▲ A baby Natal Midlands dwarf chameleon bred by Bill. Photo courtesy Bill Strand.

their care, and kits available to make setting them up in suitable accommodation quite straightforward. Nevertheless, chameleons represent not just an investment of money, but owners must also be prepared to devote quite a bit of time to their care on a daily basis."

### Chameleon keeping

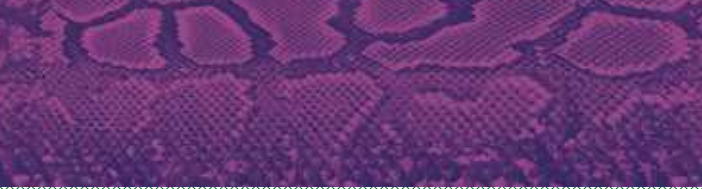
"In my work with the podcast, I am frequently asked how to start off with chameleons. On the surface, we think that the internet has made things easy because the information is all out there, but this is not really the case. The information is contradictory in many areas, so the beginner is left trying to figure out how what information to follow," explains Bill.

"Advice which is perfect for warm, humid Florida may not be valid for cool, rainy England. Here in southern California where I live, we can house our chameleons in outdoor enclosures, ensuring that they can gain maximum benefit from exposure to natural sunlight. In the UK, however, you'll need to ensure that you use a suitable ultraviolet (UV) light source instead, to safeguard against the effects of metabolic bone disease (MBD) and possibly egg-binding in laying females.

"My advice to people starting out is to read internet forums and Facebook pages to figure out what questions they should ask, and then find someone who lives nearby who keeps chameleons,"



Some chameleons, like the Mount Hanang species (*Trioceros hanangensis*) shown here, occur in Africa, but at relatively high altitude and must not be kept too hot. Bill's advice is to research the requirements of particular species that appeal to you in detail, so you have a clear understanding of their needs.



adds Bill. "It doesn't have to be in your exact town, but a person in an area with the same environmental conditions that you have."

What are the particular aspects of a chameleon's care that people need to focus on? "Universal aspects of care include a chameleon's need for water. Water is as important to chameleons as it is to us. They need it to function. And not only do they need it to drink, they, like us, use it to clean themselves. So I am probably stating the obvious when I say we must put a high priority on providing water in the correct form for them. Their quarters need to be misted regularly for this purpose," explains Bill.

"There's a podcast about water and equipment for hydrating chameleons on my website here: [www.chameleonbreeder.com/podcast/ep9-chameleons-and-water](http://www.chameleonbreeder.com/podcast/ep9-chameleons-and-water) that explains this in detail. It's really important to get this right, otherwise unbeknown to you, your chameleon could end up becoming fatally dehydrated, in spite of having water available."

## Feeding

In the wild, chameleons eat a wide range of insects, and it's important to try and replicate this type of diet.

"Chameleons can eat crickets, but it's highly recommended to ensure these insects are gut-loaded with a specially nutritious food beforehand, as a way of helping to even out their nutritional shortcomings," Bills explains.

"This in turn will help to reduce the risk of your chameleon suffering from any nutritional deficiencies. Amongst other items you can offer are grasshoppers, flies, silkworms, waxworms, mealworms, and cockroaches. Feed them these or any other insects that your local reptile food supplier has in stock, such as locusts of suitable size."

➤ Chameleons are opportunistic hunters in the wild, feeding on a variety of invertebrates, and using their remarkable reflexes to target their prey, assisted by the sticky tip to their tongue, which allows the insect to be pulled back into the mouth, faster than our eyes can register.



▲ A male Natal Midlands chameleon in Bill's collection. Photo courtesy Bill Strand.

▼ A male Usambara three-horned chameleon; a species in which Bill specialises. Photo courtesy Bill Strand.

"The key is variety, to provide the chameleon with the best range of nutrients. So as to increase the nutritional value of the feeder insects, you should dust them with a vitamin/mineral powder and also powdered calcium at different times," recommends Bill.

"You should do a lot more research on chameleon feeding and care, before considering keeping one as a pet, as this advice only scratches the surface. There

are some good books available. Many keepers would not recommend chameleons for first-time reptile keepers. Owners who don't know what they're doing can end up with serious problems with their pet, so some dedicated reading is essential to educate yourself on the needs of these beautiful animals from the outset," he advises.

"You'll need to learn about suitable accommodation, humidity levels, UVB lighting, and other aspects of chameleon care. As well as reading voraciously on the subject, consult successful keepers living in a similar geographic region as yourself. It's worth emphasising that different species often need different care."

## Breeding chameleons

Bill continues: "If you're already successfully keeping chameleons healthy, then you might be tempted to consider breeding chameleons. Having a clutch of eggs hatch or a litter born (as some chameleons, like the Natal midlands dwarf chameleon and Jackson's give birth to live young) is still one of the most exciting times for me!"

"There are a number of things that you must have organised to ensure breeding attempts go well. Mating and even incubating the eggs are relatively easy. It is when the babies hatch that things can get crazy!"







Sexing chameleons is reasonably straightforward, particularly as it tends to be only males that develop horns, which may be used for intimidating or jousting with rivals. These lizards are generally solitary and territorial by nature. A Usambara three-horned male chameleon is shown here.

Here are Bill's three tips as to what you need to have figured out before you get into breeding chameleons:

**1) Food.** Baby chameleons need a lot of very small food. You must have this planned out before the babies hatch. Calling around to see who has fruit flies or pin head crickets available when you are juggling 30 hungry baby chameleons is not a recipe for success! Start fruit fly cultures two months before the anticipated hatch date. Yes, you will probably waste a number of cups of fruit flies, but you need to have producing cups of fruit flies on demand for a hatch date that could come at any time.

**2) Housing.** Be ready to separate your babies at the first sign of trouble.

Chameleon youngsters are usually kept together in a big enclosure, but this is for the convenience of the keepers who

► **A juvenile female dwarf Jackson's or Mt Meru Jackson's chameleon – a mainland African species.** Photo courtesy Bill Strand.



▼ **Chameleons can use their tails like an extra hand.** Photo courtesy Bill Strand.



convince themselves that these young lizards are all doing fine and getting along well together. The fact is that chameleons are solitary animals and want to grow up alone.

Young can tolerate being raised together for about the first three months, but then the social stresses, which to this point were mainly non-physical, start to come out, in evident aggressive behaviours such as biting and tail nipping. The fighting soon becomes overt and the supposed chameleon paradise becomes a nightmare. You must have multiple enclosures ready so you can separate the offspring as required.

**3) Exit strategy.** As always, you need to think about what you will do with your youngsters, before allowing the adults to mate. For example, what will you do



with 60 endlessly hungry veiled chameleon babies? Sell them? How? Make sure you have homes for your babies as far as is possible before they hatch.

Whether their end home is a friend or a pet store buying a group, have a plan for where the babies will go when they reach that three month mark. And don't forget a plan B in case they don't all sell. Housing them will be your biggest challenge. Have a plan A of the ideal situation and a plan B if things don't work out as you hoped.

## In conclusion

So what final piece of advice would Bill offer to those who are keen to keep and breed chameleons? "My advice would be to let your passion for chameleons take you on an incredible journey of exploration of the world. Through chameleons, you will learn about nutrition, insects, parasites, geography, politics, construction and even crafting in terms of decorating their enclosures. It is an immersive world in which your horizons can be expanded way beyond just keeping a lizard in your home!" ❖



▲ One of Bill's Ambilobe panther chameleons. This species originates from Madagascar. Its stunning colouration means that it ranks as one of the most popular species. Photo courtesy Bill Strand.



Bill with some of his chameleon housing, at his southern Californian home. Photo courtesy Bill Strand.



▲ Ziggy, Bill's shy veiled chameleon out in the open. Photo courtesy Bill Strand.

Some species, such as Jackson's chameleon, give birth to live young, and this can be a significant factor if you are interested in breeding chameleons. This is a male, as reflected by its horns.



## Pros and cons of breeding different species

"Presumably, you already have a couple species that you know you can keep in your environment. Within that list, see if any of the species fit these descriptions," advises Bill.

**1** Livebearing. Keeping any member of this group for breeding purposes saves you the trouble of figuring out incubation details. Incubating eggs is not really that complicated though, but when starting out to breed chameleons, choosing a species that gives birth to live young may make things easier.

**2** Small clutches. The biggest challenge for first-time breeders is raising the young into healthy, well-grown specimens. The larger the clutch, then the more challenging that this becomes, so if you're choosing between a veiled chameleon that can produce 60+ babies versus a Jackson's chameleon, which is likely to produce less than 20, then perhaps this is something to bear in mind, making life easier while you are gaining experience. It is worth pointing out that chameleons giving birth to live young tend to have smaller numbers of offspring than egg-laying species.

**3** You need to be able to find homes for your chameleons when they are starting to overrun your living space, so select a species that is desirable. This does not mean justifying an expensive breeding specimen. It does require you to do your homework before starting out to breed your stock, establishing the exit strategy that I mentioned earlier. Ask existing breeders about the species you are considering, and you will find out quickly what are likely to be your best options. Usually, those that are easiest to breed will be the most commonly available.

"You also need a reality check," adds Bill. "Chameleons may seem relatively expensive, certainly compared with some other lizards, but if you entertain any ideas of making money from a breeding project, you will be very disappointed. As far as hobbyists in particular are concerned, it is very expensive to raise chameleons and the sale price of easily-bred chameleons will often not even meet the cost of feeding them for the first three months of their lives, before they can be passed on to new homes, let alone their housing and other needs."

## Further information

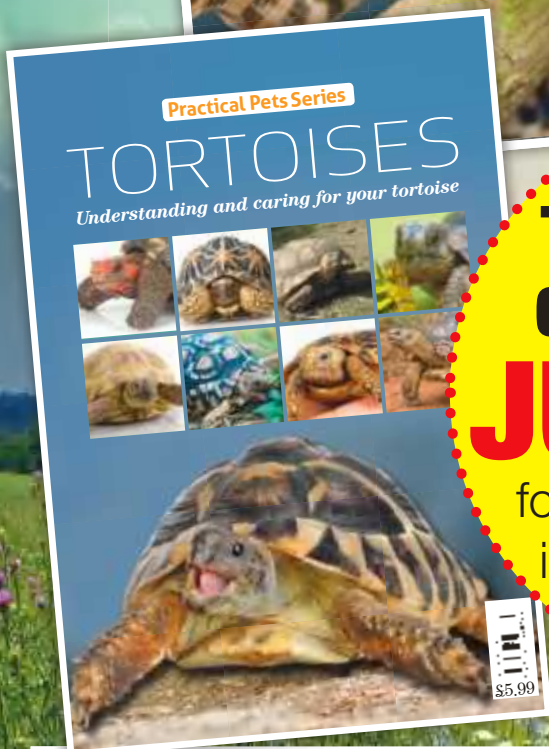
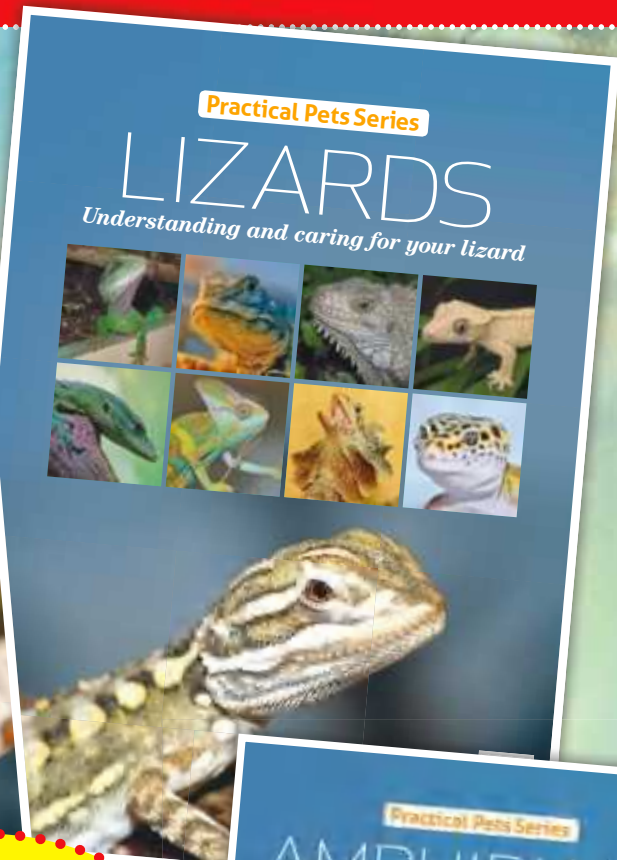
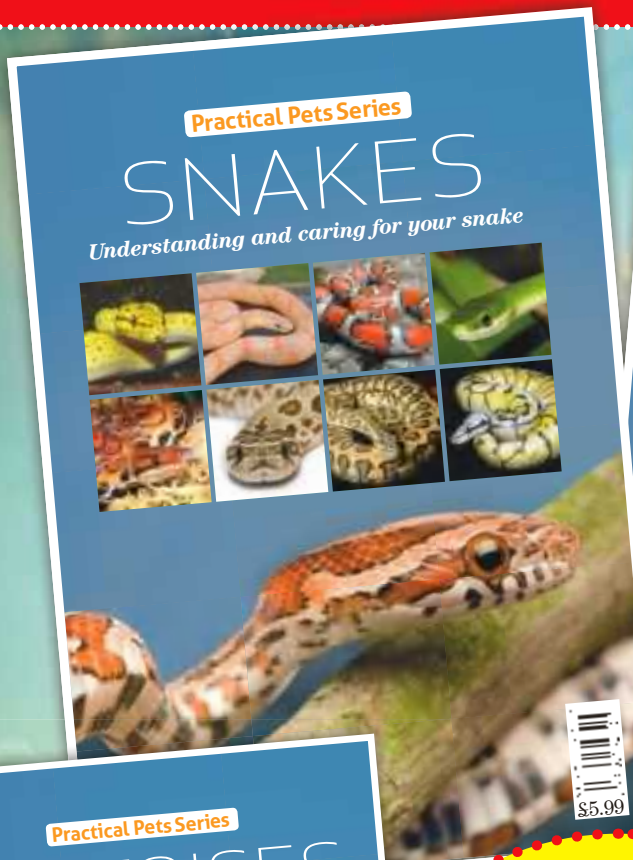
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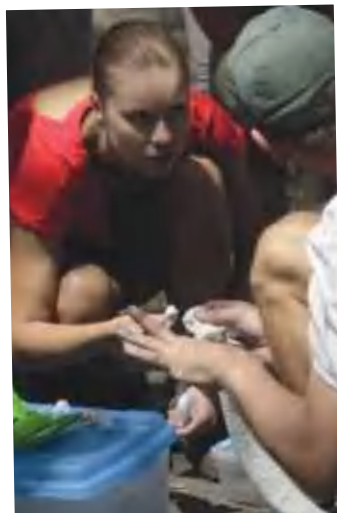
# Out of Africa



## Encounters with puff adders

Paul Donovan discusses the lifestyle and threat posed by Africa's most deadly snake.

I consider myself to be truly lucky, in that the passion I had for snakes as a child has since provided me with a career for the past 35 years. I have a number of people to thank for this, and apart from my parents, one was C.J.P. Ionides. I never met him in



◀ My only venomous snake bite. And I had to be filming for television at the time!

person - I'm far too young! - but it was the captivating exploits about his life, particularly those contained within the book entitled *Snake man: The story of C.J.P. Ionides* by Alan Wykes, which not only fostered my interest in snakes, but also my desire to move to Africa and work with them in the wild; a dream which took me a long time to realise.

Ionides was a big game hunter, born in 1901, who became the world's first professional snake catcher supplying the growing number of zoological collections that were set up all over the world in the 20th century. Until it was unfortunately stolen, my copy of this book took pride of place on my bookshelf, and occasionally when I read it, it would bring back vivid memories of my early years as a snake keeper. I often wonder if any of the snakes that I'd looked after at that stage could have been the offspring of some of the individuals that Ionides himself had caught. It would be nice to think that they were...

### Living dangerously

One of the things that stands out in my mind more than anything else from the book was Ionides' fascination for puff adders (*Bitis arietans*). This, as it turned out, was also to be the first venomous snake

that I physically handled and milked, and it is also the only venomous snake to have bitten me - an experience that I'm not keen to repeat.

I cannot say that my fascination with them extends quite to the extreme of Ionides himself, who believed that if he was repeatedly bitten by a venomous snake, he would become immune to its venom. He was determined to test his theory. So after catching a particularly large female puff adder, Ionides would regularly sit at his dinner table and eat his meals with this snake either wrapped around his neck, or coiled on the table.

Needless to say, in true puff adder style, it helpfully inflicted several bites on him. The ironic thing is that Ionides never suffered any side effects from them though, and lived to a respectable old age, in spite of his hazardous lifestyle. He died in 1968.

### Truth and reality

It is difficult to establish why no symptoms arose. In the case of a single bite, you could attribute this to what is called a 'dry bite' where no venom is injected. But it is difficult to reason that every bite was a dry bite.

Equally, building up resistance to a particular venom may take several years of



The puff adder is a squat, bulky snake.

OUT OF AFRICA | PUFF ADDER



➤ A mode of movement called caterpillar reticulation means the puff adder moves in a straight line.

▼ Individuals from the Gambia have a pinkish tinge to their bodies.

receiving small doses, which gradually increase in size until resistance is gained to the level where a full dose can be administered. You do not build up immunity following a single bite. Anyway, for whatever reason, Ionides survived this experience and lived to write a fascinating account of his life in Africa himself, called *Mambas and Man-eaters* published in 1966, and his more autobiographical work, called *A Hunter's Story* (1965).

From my early days working in zoological collections, where every one had puff adders in the collection, I now have the opportunity to work with them in the wild. As a result, I have gained a better understanding of the biology of this most feared of all African snakes.

### Short and stocky

The puff adder is not a particularly large snake, reaching an average length of 60-100cm (24-39in), although individuals from East Africa (principally Kenya) are regularly reported to attain lengths in excess of 180cm (71in). It is difficult to know why such disparity occurs in size between individuals found in the southern parts, compared with those from eastern areas of their distribution.

This could be related to their diet, or simply a reflection of genetic variability. Another interesting fact in terms of breeding is that the eastern race consistently gives birth to larger litters than those from other regions.

What sets this snake apart from many

other African vipers is their bulk. Adults often exceed 30cm (12in) in girth in my experience, and I am talking about the more widely distributed individuals in this case, not those of bigger individuals from eastern areas. It is, in essence a bulky, squat snake.

Another prominent features of this viper is its large, flat, triangular-shaped head,



whose size underlies the reality that it packs a pair of very large venom glands. The eyes have a golden or silver hue and elliptical pupils, while the body is covered in small, overlapping leaf-like scales which are heavily keeled.

### Colour variations

With such an extensive distribution, the diverse habitats where puff adders can be found has resulted in a wide range of colour variants being recorded. These range from pale grey through to brown, with a series of light or bold coloured chevrons running along the back. And it is not uncommon to find individuals from Botswana, particularly those bordering the Kalahari region, to be a



A dark coloured juvenile encountered in South Africa.



▲ Males and females have different tail lengths, with those of females being much shorter.



striking yellow or orange in colour with deep black markings and creamy speckling. Conversely, I have seen individuals from the Gambia which are a pinkish-brown colour with darker brown markings.

On either side of the head are two dark oblique stripes. One of these runs through the eye to the upper labials, and the second is posterior to the eye, extending to the rear of the jaw line. In some individuals, particularly those from Namibia, the stripes can be quite thin and off-white in colour.

A thin pale stripe also runs across the top of the head from one supraorbital scale to the other in virtually all cases. The underbelly is yellowish-white, sometimes broken by black or brown spots. Individuals confined to the drier habitats tend to be paler in colour than those found in moister parts of their range. Males also tend to be slightly more colourful than females.

### A difference in scalation

A subspecies known as *Bitis a. somalica* has been described from Somali. This form differs from the nominate race by the presence of keeled sub-caudal scales, although its overall colouration is generally the same. It has been suggested that the presence of these keeled scales may aid the snake moving in a sideways motion, as it is confined to quite sandy environments, although its range does not extend into actual desert areas.

I find this idea rather hard to accept, as the presence of these scales, restricted just to the tail, would not by themselves give the snake the ability to move in a sideways fashion. The fact that the snake moves in a caterpillar-like way, with blocks of muscles pulling and pushing it along, coupled with its wide girth, would itself give sufficient mobility. I personally suspect that these keeled scales enhance the entwining of the tails during mating.

▲ A light coloured juvenile found at the edge of the Kalahari desert.

➤ Puff adders are ambush predators.

▼ Some puff adders can be quite dark in appearance.



### Habitats

The range of different habitats inhabited by puff adders is as diverse as their distribution. With the exception of mountain tops, rain forests and deserts, almost all bio-types have been successfully colonised. From my experience with the snake in Botswana, puff adders would seem to favour semi-arid areas such as savannahs and bush veld where they secrete themselves away out of sight, beneath bushes and boulders.

It is often written that puff adders are slow-moving snakes, relying on their 'caterpillar reticulation' for locomotion. While it is true that this mode of movement is not as fast as that adopted by other terrestrial species, puff adders are nevertheless capable of achieving a good turn of speed when necessary.

Movement is achieved by blocks of alternate muscles contracting and relaxing, with these impulses travelling down the length of the body in a wave-like motion. The snake thus moves in an almost straight





▲ On either side of the head are two dark oblique stripes.

▼ The actual soil colour can influence the snake's appearance.

line like a caterpillar. This form of locomotion is well-suited for a snake of such bulk, and although it might appear slow and cumbersome, it does still allow for acceleration when necessary, relative to the puff adder's size and bulk.

Although this is primarily a terrestrial snake, it is not uncommon to come across individuals in low-lying bushes. From my observations, this climbing seems to be more widespread in pregnant females than

it is in males, which is rather strange considering the extra weight and girth they are carrying around at this stage, making them even more cumbersome.

I suspect this tree climbing behaviour may serve largely as a means of protection, as I have noticed it tends to be more prevalent in individuals which find themselves in areas with little ground cover. Where there are retreats available at this level, tree climbing is less common.

Given the chance, both sexes will also take to water and are capable of swimming remarkably well; their girth gives them good buoyancy, thanks to the large

capacity of their lung. In fact, following rainy periods, it is not uncommon to find puff adders openly soaking in pools of water. They probably use these pools as a way of rehydrating themselves.

### Ambush predator

As a result of its bulky proportions, the puff adder is an ambush predator. Rather than going in search of prey, these snakes wait for prey come to them. This is an efficient means of hunting, for while the snake is lying up, it is not burning valuable energy seeking out its meal. This means that the caloric content of the prey when it is captured is thus used more efficiently.

The puff adder may lie in wait for its prey for days, often coiled next to a rodent run waiting for an unwary warm-blooded traveller to pass along it. When the rodent does so, it is dealt a lethal bite which it has little chance of avoiding. The puff adder has one of the fastest strikes of any snake, inflicted a speed equivalent to 6m (20ft) per second.

Although rodents constitute much of the snake's diet, its tastes are quite cosmopolitan, ranging from birds, amphibians and lizards through to other snakes. Their venom is quick acting; I have seen adult rats drop dead almost instantly following a bite. Typically, once bitten, the prey is released and then later tracked by the snake. On occasions where the prey is quite small, it may be held onto until the deadly effects of the venom have become apparent.

### Bites and humans

The puff adder's highly cryptic colouration renders it almost invisible as it lies amongst the undergrowth. It will seldom move when disturbed, preferring to advertise its presence by expelling air loudly from its lung, although a warning is sometimes too late, and may not necessarily always be given in any case. This is one of those snakes where it is a matter of getting out of







its way, rather than expecting it to move out of yours.

It is difficult to put a precise figure on the number of people who suffer puff adder bites each year, but the total certainly runs into several thousands. Such are the number of its victims that this species accounts for around 80% of all African snake bites. Most result from people simply not seeing the snake as they are walking through the bush, and then treading on it. This is reflected by the fact that the great majority of bites are sustained to people's lower limbs.

A further factor contributing to the relatively large number of bites is the snake's association with urbanised areas. With the increased sprawl of humans into the puff adder's habitat, so greater contact and conflict between the two parties is inevitable.

No one should underestimate the lethal nature of this snake either. Its chunky physique and apparently docile, almost beguiling nature masks a species that is quite different in character. Although puff adders may not be capable of moving with the grace of an agile cobra, they certainly can deliver a ferocious bite that is all but impossible to avoid.

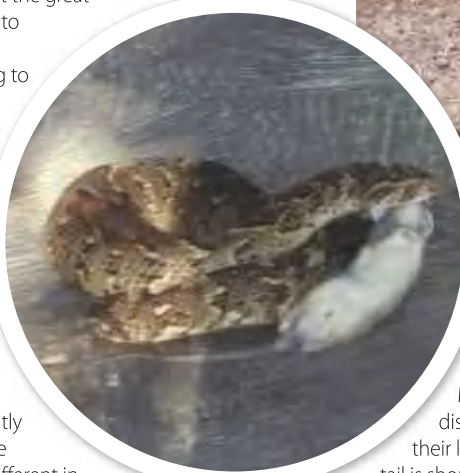
Large quantities of virulent cytotoxic (cell-destroying) venom are delivered deep into the flesh through fangs measuring 15-18 mm (0.6-0.7in) in length. Here it causes intense pain, swelling and necrosis (tissue death). Widespread damage emanating out from the site of the bite is not uncommon and reconstructive plastic surgery is frequently the norm. Even where surgery is not required, a common result will be a protracted healing period.

A venom yield for a good-sized puff adder is in the region of 100-350 milligrams, with just 100 milligrams being sufficient to kill a human. Deaths usually arises from a combination of shock, massive blood loss and kidney failure.

Typically, a bite is administered from a coiled position, with added impetus gained through drawing the head and forepart of the body backwards before striking. Although bites are common, fatalities are

▲ Hidden amongst the grass, the puff adder is easily trodden on by people and livestock alike.

▼ These snakes enjoy a varied diet.



▼ A host of young puff adders.



fortunately rare, provided that the victim receives prompt medical attention and antivenom.

## Breeding

Males can be easily distinguished from females by their long tapering tails; the female's tail is short and stubby, often measuring less than half that of her mate. Pairing takes place late winter or early spring, and can also occur during late autumn, depending on the puff adder's distribution. Females

release pheromones that attract males like wasps around a jam pot.

During the breeding season, males take part in so-called 'combat dances' where they wrestle one another for the right to mate with receptive females in the neighbourhood. The victor is the one who pins the other to the ground. These fights are not as intense as those seen in rattlesnakes (*Crotalus*), or black mambas (*Dendroaspis*), and tend to be more scuffles taking place at a low level, rather than entailing the snakes rearing up off the ground.

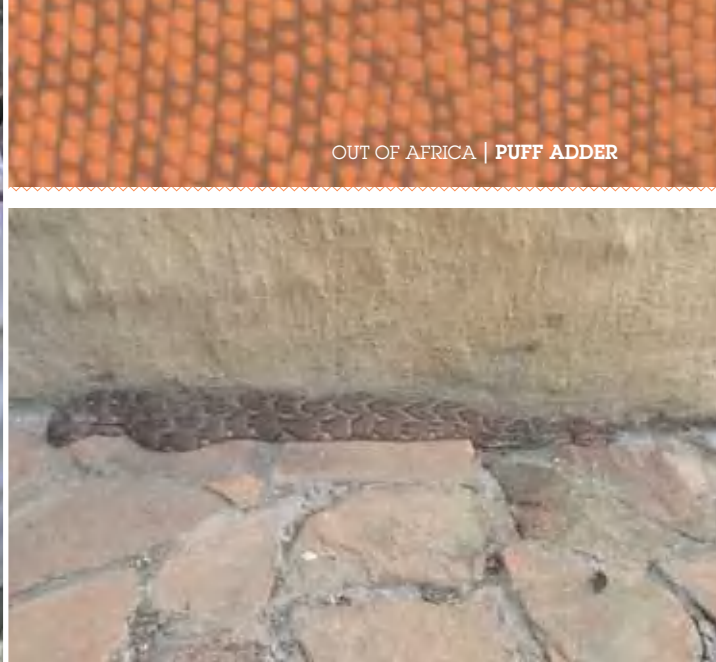






▲ Paul discovered this puff adder at the back of his house.

◀ A common occurrence in urban gardens – Paul removes a puff adder safely.



OUT OF AFRICA | PUFF ADDER

Litter sizes are large, averaging between 20 and 50 young. Interestingly, individuals from East Africa consistently give birth to bigger litters than those found elsewhere through their range. The largest litter recorded to date was that of a female from Kenya, who produced 156 young, which also ranks as the biggest known brood of any living species of snake.

One of the things I have come to realise in all my years working with and studying this snake is that the size of the brood is not necessarily dictated by the length of the female. Immature females are capable of giving birth to proportionally large litters in

relation to their body mass, when compared with much bigger females. I remember having one female who measured around 45cm (18in) giving birth to 23 young.

Irrespective of the size of the female, young puff adders seem to be fairly consistent in appearance, with an average length of 15-20cm (6-8in) and the diameter of their body corresponds to the thickness of a finger at birth. As with adults, their colouration tends to differ according to the terrain; in most cases, it is yellowish or pinkish, with contrasting brown chevrons.

From the moment they are born, young

puff adders exhibit the belligerent temperament typical of the species. A large number of bites are sustained by children in Africa who pick up juvenile snakes thinking them to be harmless. In fact, the venom of a juvenile is significantly more concentrated than that of an adult and therefore much more potent, drop for drop, based on their body mass. As with the adults, the young enjoy a varied diet, but show a penchant for toads. Interestingly, this particular fondness is lost with maturity.

### Tail-end

Despite their malevolent disposition, a reputation for being the most dangerous snake in Africa, and delivering a bite whose venom causes your flesh to rot away, I still have a soft spot for puff adders. My fondness for them has grown immensely since moving to Botswana as I have learnt considerably more about their natural history and biology.

When you begin to examine the puff adder's lifestyle, it is easy to sympathise with it. True, it is responsible for more bites than any other African species, but as humans encroach more and more into the snake's territory, taking land for grazing, arable use or urbanisation, can we really blame the puff adder for reacting in the instinctive way that it does? ❖

## Further information

Various editions of *Snake man: The story of C.J.P. Ionides* by Alan Wykes are available, and secondhand copies can be purchased from Amazon and other online booksellers from around £4.50 plus postage at the time of writing. C. J. P. Ionides's own books, entitled *Mambas and Man-eaters* and *A Hunter's Story*, are selling for around £30 secondhand at present or you can borrow them through your local library, via the inter-library loan scheme.

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# The first successful breeding of Madagascan plated lizards?

John Courteney-Smith MRSB of Arcadia Reptile reports on breeding this species, which may be the first recorded success.

In late April 2015, I had the opportunity to add the Madagascan plated lizard (*Zonosaurus madagascarensis*) to our collection, based at Arcadia's headquarters in Surrey. Plated lizards as a group have always appealed to me. Their diversity, slightly roughened appearance, colouration and social interaction make them a highly attractive choice both for study and display purposes.

In addition, there appeared to be no historical records of captive breeding with any member of the group, although I have heard of some plated species laying infertile eggs. This group therefore represented an ideal choice, in terms of taking the wild data that was available, based on the distribution of the particular plated lizard chosen, and then hopefully, we would be able to utilise this data in order to breed the species successfully.

It seems, based on anecdotal reports, that that it is rather common for recently-arrived wild-caught females to lay on arrival, although this strikes me more as a case of ranching (hatching eggs obtained from the wild), rather than genuine captive-breeding. In the end, thanks to my personal fascination with

► A Madagascan plated lizard, photographed in the wild.



the flora and fauna of what used to be the paradise of Madagascar, I decided upon one of the species of plated lizards from this island.

## Appearance and range

The Madagascan plated lizard is long and slender, and highly coloured with red/orange spotted sides. It also has the more common double yellow stripes along the dorsal edges of its body, running from the nose to tail bone. It is by no means the smallest nor largest of the group that occur over Africa.

The species occurs widely across

Madagascar, and is present on a numbers of the small offshore islands to such as Nosy Be and Nosy Sakatia, being regarded as generally common throughout its range here. It is mainly terrestrial by nature, tending to frequent scrubland or forested areas where there are open sunny patches of ground accessible as well. These lizards will climb on occasions, and can sometimes be found up trees, and also appear able to adapt well to live in plantations or cleared areas of forest.

I was very interested to see a recent shipment of these lizards. There appeared



Cork bark can provide basking opportunities and retreats.

FEATURE | PLATED LIZARDS

documented.

The UV index or quantity of solar energy in these habitats is termed as extreme. This means that because of the significant amount of associated radiation, many of Madagascar's species have had to evolve good levels of protection against over-exposure. Indexes listed on the weather reports indicate figures between 6-12 at basking periods, depending on the season and location. This is comparable to the Australian outback!

### Making a choice

When it came to choosing the Madagascar plated lizards, I had seen a group of animals earlier in the year. They had been acclimatised for well over a 12 months following their arrival, and as such, they had been treated for parasites,

to be a lot of diversity within the group, in terms of both size and patterning. It raises the question as to whether there are as yet unrecognised subspecies within the Madagascan population. It made me think of how the classification of the panther chameleon – long thought to consist of a single species – has now been overhauled in the light of the latest scientific evidence. DNA studies on the Madagascan plated lizard could be very interesting.

The Madagascan, like all plated lizards, is truly omnivorous and will benefit greatly from a varied diet. This species is well coloured to blend into its environment and will spend most of the time on the ground or clambering over fallen branches and rocks. Madagascan plated lizards do have the typical elongated back toe and thick powerful tail of a powerful runner, and I can testify to both their strength and speed. Having said that, however, they do not seem nervous or inclined to run for no good reason. I can also quite truthfully say that they have never tried to bite either!

### Climatic matters

Madagascar is a rich and biologically diverse Island, being home to many endemic species. It is rather hot and humid all year long. Temperatures are pretty stable over much of the year at around 28-30°C (82-86°F) with the humidity level on the perimeter of a forest being stable too, at 70-80%. There is a slightly cooler season between July and September, and it could be that this fall-off of around 5-8°C (8-14°F) helps to trigger breeding in these lizards in due course.

There are freshening winds, as is common on islands, and the sun is very important here as well. We still do not truly understand many of the biological interactions between the sun and reptile life, although the importance of UV and the vitamin D3 cycle is now well-



Plated lizards on Madagascar are exposed to a surprisingly high UV index.



were well-settled and more importantly, the females were not carrying eggs from before their arrival. We obtained a trio of one male and two females. They were obviously adult, and had been housed together, so they were familiar with each other.

In terms of size, they were all between 35–45cm (14–18in) in length, including the tail, and were scale-perfect. Sexing is reasonably straightforward. The male shows a deeper level of colouration along the flanks but the females are wider around the girth. It is interesting to note that as with many other species of lizard, this level of colouration increases and decreases with fluctuations in both temperature and the UV index. This trait is not, however, very common with the other mainland African races of plated lizard in my experience.

## Housing

We had set up a 1.5x0.9x0.6m (5x3x2ft) vivarium, which was fully bio-active. We used EarthMix as the substrate because of its high mineral content and good drainage. This was added to a depth of 5–7.5cm (2–3in), depending on the zone. On top of this medium, we rolled over a matting of live forest moss to grow, and this covered more than half the enclosure.

Rocks were placed in piles at the basking/hot end of the vivarium, and sturdy branches were placed in a tangle horizontally across the whole 1.5m (5ft) of living space. We added some live plants and plenty of springtails, watered the whole system well and left it for around a week to settle.

In terms of environmental maintenance, we used a 75w halogen heatspot lamp running through a HabiStat mechanical stat. We also placed a heatmat on one side at the basking end to come on during the night. We added



► Leaves can be used to provide an area of cover for these lizards. Photograph courtesy Guérin Nicolas.

▼ The very first captive-bred Madagascan plated lizard, just moments after hatching.







◀ Retreats are important in the design of vivariums.

the centre of the enclosure to increase lux and to help cater for plant growth. We maintain a high level of humidity in this large enclosure of around 60-80% depending on the time of day. It is methodically sprayed down twice a day.

### Establishing a routine

I added the lizards after a further week of checking the system for faults. All three were given a visual health check before being placed inside the enclosure. It was apparent very quickly that these lizards not only maintained a complex social hierarchy but that they would go on to become 'creatures of habit'.

I can honestly say that the whole enclosure is well used at differing and predictable times of the day. The male in this case is dominant. He will copulate with both females frequently. He will always bask at the highest point and first, before being replaced by the more favoured female and then the subordinate female.

However, I have not seen any hint of aggression between the three adult animals at any time. They do seem to have patterns of behaviour that allow for a harmonious lifestyle. Turns are taken with regard to feeding and basking, and I have more than once seen the females catch and share food items with each



into the system, featuring as part of the light and shade method, a 39w high output T5 12% UVB ZooBar. This is a powerful twin lamp zoological fitting that projects high quantities of UVB over great distances.

I measured the UVI with a Solarmeter 6.5 and found a usable solar gradient of zero at the cool end right the way up to 8+ at the very top of the basking point on the uppermost branch. This is VERY high and great care must be taken with regard to both animal and human health under these circumstances. We also added in a single 22w Jungle Dawn over

▲ Basking is a vital part of the lizards' daily routine.

other, although not with the male.

In terms of feeding, they really will eat anything at all. We feed a mix of morio worms, waxworms, dubia roaches, hopper locust and crickets as their livefood offering. We also provide some fresh green food and of course HerbiMix as a source of dried plant matter and fruits. They feed on a 'little and often basis' and take the plant matter occasionally. I would also assume that defrost rodents would be taken and broken quail eggs could be a useful addition to their diet as well. Livefoods are supplemented after gut-loading with EarthPro-A.



## Lifestyle

The lizards settled in well, and it soon became apparent that they preferred to be fed at certain times, lining up by the glass at 11.00am each day. This may be learnt behaviour or simply coincidental, but this routine is evident on most days.

The male will emerge from under the deep substrate first and slinks upwards towards the ZooBar where he will bask each morning for around one hour. I have measured the index here and it is around 7.5 where he positions himself. His colouration brightens significantly and rapidly. His flanks will redden quickly and the yellow stripes along the back become rather golden. He will then allow the females to bask; they tend to expose themselves to an index of around 3-4.

After feeding, the group will generally disappear until the end of the day, when they will re-emerge to feed shortly before the final spray down. It is at this time that they are most active. They then retreat back into the substrate when the lights go off. I maintain 10-12 hours of high heat and lighting a day.

## Breeding

Mating is a rough affair but not as rough as in some species such as the eyed lizard (*Timon lepidus*). The females will submit quickly and the male will grasp the neck, copulation will occur and the pair will stay joined for around 5-10 minutes. Madagascar plated lizards mate frequently and mostly before rain!

I have never witnessed egg laying but I have found eggs. I am a big believer in the theory that the 'mother knows best'



▲ The vivarium housing the young plated lizard after being sprayed.

in terms of choosing a good egg-laying site. If the system is maintained as in the wild, then I felt there would be no reason to take the eggs for artificial incubation from these initial experiments. None has been removed. Nothing really is known about incubation temperature or time. From my studies, I would suggest that the average incubation period lies between 40-50 days.

The system is maintained and slightly cycled in the UK winter, with the temperature being reduced but only by 5°C (8°F). Food is always offered, as is a water source which is also actively used. In terms of hydration, Madagascar plated lizards do willingly expose themselves to water droplets from the daily spray downs of their enclosure. I can therefore only surmise that this facilitates their hydration, as with many other species originating from hot environments.

The females remain chunky at all times, so it is very hard to spot the final stages prior to egg laying when a female is gravid. Fat stores around the tail also remain stable, as do their levels of activity.

It was in early November that we spotted the first baby Madagascar plated lizard running around the enclosure. It had just hatched *in-situ* in the vivarium and had traces of egg still attached too its body. All three adult animals were surrounding it, penning it in. It is not clear as yet whether this was maternal interest or impending predation. They did not show any signs of hunting at that time.

As a precaution though, the baby was removed to another large bio-active system. A week later, a second baby was spotted and removed from the enclosure. The babies resemble the adults but without the high reds along the flanks.

## Behaviour of the young

Young Madagascar plated lizards grow quickly and will eat anything that will fit in their mouths. I have to point out here that the babies, unlike the adults, are

aggressive to the extreme. In this case, the older sibling eventually hunted down and fought the younger individual, although they were housed in a densely planted and spacious enclosure.

A lesson can be learned here and that is always to keep the youngsters separately until they reach maturity. They grow quickly, with their distinctive colouration emerging as they get older. Perhaps surprisingly, the young lizards remained very nervous and would not be caught. They also show the same tendency to burrow as is common with the adults.

Mine seem to prefer large waxworms but they will regularly feed on large fruit flies also. The environmental system for the youngsters resembles that used for the adults, but with a basking temperature of 26°C (79°F) and a UV index at basking of just 4. I believe that the fully protective scales will develop with age; as such it is important to not irradiate young animals.

## Cracking the code!

We believe, having checked keeper and zoological records extending back to the 1800s, that we are the very first to produce genuine captive bred plated lizards of any species from adults that are well-established.

It seems clear that it was replicating the natural environmental conditions of these lizards which gave rise to this success. Since then, the adults have maintained their usual behaviour patterns and the babies are continuing to grow well. There is still much to learn though - notably how to achieve a regular and seasonal system of successful breeding. All of the answers to the care and breeding needs of a particular species are obviously hidden in the wild animal, and we need to unlock this knowledge to achieve success. By mirroring what happens in the wild, it is clear that "Wild Re-Creation" provides us with the key. ❖



▼ The young Madagascar plated lizard exploring its enclosure.



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# GIGANTIC frogs and toads

Paul Donovan considers five mega-large members of this group which have featured in the hobby, outlining their lifestyles and care.



**T**here are more than 2000 species of frogs and toads, collectively known as anurans thanks to the name of their Order Anura, meaning 'tail-less'. There is far less variety within the group, however, compared with reptiles such as lizards or snakes.

For those who like large animals, these amphibians really are a bit of a disappointment! Even the other main amphibian group, comprising the tailed amphibians, at least offers giant salamanders that can grow to 18m (6ft) in the case of the Chinese species (*Andrias davidianus*).

When it comes to their size therefore, most frogs and toads are, to be brutally honest, relatively uninspiring. Granted, they may be colourful but when it comes to physical impact, they are definitely diminutive and unimpressive. That is, of

course, with the exception of the five true giants of the hobby.

## ■ Marine toad *Rhinella marina* (*Bufo marinus*)

**Family:** Bufonidae.

This is the largest toad in the world, representing a true leviathan of the amphibian group. It is also an infamous species, with a reputation for breeding like the proverbial rabbit, as females can produce tens of thousands of eggs at a single spawning.

Originating from the subtropical forests of Central and South America, the marine or cane toad has been introduced intentionally to a number of countries where the species has proven to be a serious threat to various forms of indigenous wildlife. Sugar cane farmers in Australia thought the marine toad could

be the answer to their prayers for eliminating pests in their plantations, following what appeared to be initial success using this species for pest control purposes in Hawaii and the Philippines.

With their name changed to cane toads, so a small number of these amphibians were imported to Queensland and released into the wild in 1935. Initial results there also appeared encouraging, and the authorities subsequently sanctioned the release of some 62,000 young toads to the wild within two years.

## Problems arise

Only later did the problems start to become evident. Firstly, the grey-backed beetles which the toads were supposed to control lived in the upper reaches of the sugar cane plants, but these amphibians are not good climbers. So they preferred





▲ Cane toads are incredibly prolific when spawning.

to hunt native Australian species on the ground, grabbing anything they could cram into their large mouths and swallow.

Furthermore, there were soon serious concerns stemming from their reproductive rate, because these toads bred on a massive scale, in the absence of any effective predators in their adopted new homeland. Before long, they had become more of a problem than the issue which they had been brought in to solve.

The problems when you deliberately release a non-native species into a country where it is not present are likely to be many and varied. In the case of this toad, it had an abundance of food, and favourable climatic conditions which were well suited to allowing it to breed readily. And thirdly, which was possibly the most serious concern of all, there were no natural predators adapted to feed on these toads.

Those animals that attempted to do so quickly suffered the consequences of eating a large amphibian with two significant poison glands on either side of its head. And the poison exuded from these can potentially kill just about any animal - domestic or wild - which mistakenly sees them as an easy meal. Furthermore, their tadpoles are toxic as well, so predators soon learn to avoid them.

## Other localities

It is not just Australia which fell foul of this toad, but so did Thailand. Cane toads were released to control rats in paddy fields. In the Philippines, where it was first introduced as a pest controller in 1930, the cane toad's numbers have grown to the extent that it is the commonest amphibian throughout the islands. This species has achieved its status there partly by preying on its fellow amphibians as well.

Native wildlife in a host of other countries ranging from New Guinea to various countries in the Caribbean has also suffered from the ravages of introduced cane toad populations. Only in a few cases, as on Cuba, did attempted introductions luckily fail - twice in this particular locality.

## Widespread issues

Unless you do your homework first, releasing non-native species into a new country for biological control purposes can have serious repercussions. That's why there are reams of paperwork involved nowadays, in order to protect native fauna, and strict penalties exist for unauthorised releases. Unfortunately, the risks simply weren't appreciated back then.



▲ The natural range of the cane toad, in purple, with some of the areas where it has been introduced successfully being shown in red. Map courtesy LiquidGhoul/Tnarg 12345.

▼ The glands can be clearly seen from above, as well as the side of the cane toad's body.

The consequences of getting it wrong with this species have been horrendous. Such was the way in which the cane toad spread in Australia that not only did the species decimate local wildlife, but it was responsible for health problems in people who picked these toad up without realising they were likely to acquire some of the toxin on their hands at the same time, and then ate or put their fingers into their mouths.

The situation became such a problem that the government decided to pay a bounty for every cane toad killed. Over the course of several years, tens of thousands of toads were killed by bounty hunters, but this had

little effect on their numbers. And even today in Australia, a task force operates to monitor the movements of this invasive species and to prevent its further spread if at all possible.

## Large versus small

People sometimes describe this toad having an ordinary appearance, but how can a toad that is clearly so much bigger than its relatives be referred to in this way? After all, it ranks as the largest four-legged amphibians that you are likely to encounter or keep. Females can tip the scales at up to 2.65kg (5.8lb) and measure as much as 38cm (15in) from their snout to their vent, exceeding their mates in size.







Never be tempted to house large and small individuals together, because like other giants of their kind, cane toads are cannibalistic by nature. In any event, it is better to start out with a young individual, which is likely to settle well in your care and become tame.

Large specimens tend to be less inclined to adapt quickly after a move. It is also important to avoid the temptation to pick these toads up continually, as handling of this type can lead to feeding difficulties and associated problems, creating a downward health spiral for the amphibian.

### Sensitive by nature?

I worked in a small zoological collection in the UK for several years, and the educators who did the public displays were given six adult cane toads for demonstration purposes. Over the course of several weeks, I noticed that a number of these impressive animals had gone of their food, and were becoming seriously anorexic in appearance as well - the toads that is, not the educators!

When the amphibians were given a break though, and no longer being handled regularly, they quickly regained their weight once again. The moral of this experience is to keep handling to the minimum. They are not pets that appreciate regular handling. There is also the risk that their toxins could get into your body if you have a cuts on your hands. It is always better to handle these and other amphibians as necessary, wearing disposable gloves for this purpose.

➤ A group of cane toads in Australia. They occur at much greater densities here than in their American homeland.



▲ The actual appearance of individual cane toads does vary, with some appearing more colourful than others.

Normally, however, these toads are truly gluttonous feeders and will wolf down as much food as you can feed to them; rat pups, adult mice or large locusts. It is important to monitor their condition however, as if an individual looks as though it is getting rather portly, you need to reduce its food intake. Otherwise, excessive feeding will shorten its life expectancy.

It's strange but true that in various areas of the cane toad's range, people

### Did you know?

The goliath frog (*Conraua goliath*) is potentially the heaviest anuran alive today. It can grow to 32cm (12.5 in) in length from snout to vent, and may weigh up to 3.25kg (7.2lb). This species originates from just a small area in Cameroon and Equatorial Guinea.

sometimes actually lick the poison glands on the sides of its head, as this is reported to have hallucinogenic properties. In turn, this type of behaviour has actually been known to lead to serious drug dependency problems.

### Common toad *Bufo bufo*

**Family:** Bufonidae.

This species is very widely distributed over much of Europe, North Africa and Asia. It is a robust, powerfully built amphibian with a huge, broad head. Its base colouration is grey or brown, sometimes extending from sandy to brick red or even olive green, with its leathery skin being covered in an abundance of 'warts' and tubercles. The underside of the body is a yellowish or off-white shade, often with a marbling effect.

The head of the common toad is significantly broader in width than it is in length, with its eyes being large and bulbous. As in the case of the cane toad, its larger cousin, there are two very large parotid glands situated behind the eyes.



Regular handling is not recommended for cane toads (or any of the other species listed here).





▲ A common toad displaying its defensive posture, which is designed to intimidate. Photo courtesy Łukasz Olszewski ImreKiss

► Sometimes, bluffing doesn't work, even for a large toad. Photo courtesy Richenza.



◀ The range of the common toad extends naturally over three continents. Mapo courtesy Bkimmel/PD.

▼ Earthworms are a popular food of common toads.

range. During the day, the toad spends its time hidden beneath damp logs, rocks or in vacant animal burrows.

### Battle of the titans!

One of the chief adversaries of the common toad is the grass snake (*Natrix natrix*). And when the two come head to head, it becomes a matter of resolve as to which one backs down first. The snake thinks it has chanced upon an easy meal, while the toad has other ideas.

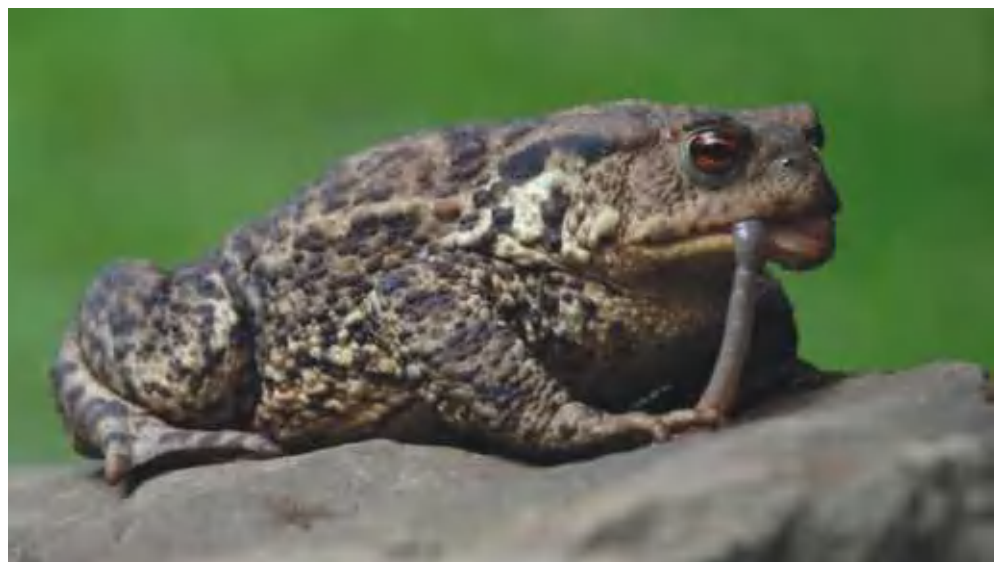


These manifest themselves as a long raised 'lump,' with small black pore holes through which the poison is exuded.

Measuring up to 16cm (6.3in), this is the largest toad in Europe, with females being slightly bigger than males. Interestingly, those specimens from southern parts of its range tend to be the largest.

The common toad is very much a terrestrial species that is generally found, rather surprisingly for an amphibian, in quite dry habitats such as woodlands, scrub, open ground or cultivated areas, and it will often venture into gardens. Nocturnal in nature, it will keenly go in search of insects and earthworms that have ventured to the surface following a period of rain.

Be under no illusion though, small rodents will also be devoured by large common toads if they pass within striking







As soon as the toad sees the snake, it raises itself high on all four legs, and presents the top of its head to the snake. This act is all about making itself look as large as possible. Nine times out of ten it works, but I once watched a very determined grass snake call a toad's bluff, and the toad did not live to see another day.

## Breeding

At some stage between early and late spring, adults migrate, often over some considerable distance, to communal breeding ponds where, driven to a mating frenzy, males will seize anything that moves - or not as the case may be; I once saw a group trying to mate a yellow tennis ball! Females are prolific and can produce as many as 10,000 eggs each, in long gelatinous strings.

Such is the inherent desire of males to mate that a female may literally find herself at the centre of a scrum, and end up drowning under the weight of her suitors. Unlike many other toads and frogs, male common toads lack external vocal sacs, and therefore have no mating call.

## American bullfrog *Rana catesbeiana*

**Family:** Ranidae.

It is said everything about the USA is big, and when it comes to the American bullfrog, this is no exception to this rule. It is best described as being like a wrestler in build, being large, muscular, and heavy bodied. And at 20cm (8in) long, it is a force to be reckoned with.

Its native distribution takes it through North America although as is often the case with the species covered here, it has been introduced (either intentionally or otherwise) outside its native range. Of the five mega-anurans covered in this article, I



▲ The spawn of the common toad in the form of strands.

► A powerful build characterises the American bullfrog.

▼ Common toads are at risk of being run over on roads when returning to ponds for spawning purposes in spring. Volunteers set up toad crossings to try and safeguard as many as possible, assisting them across the road.



At some stage between early and late spring, adults migrate, often over some considerable distance, to communal breeding ponds where, driven to a mating frenzy



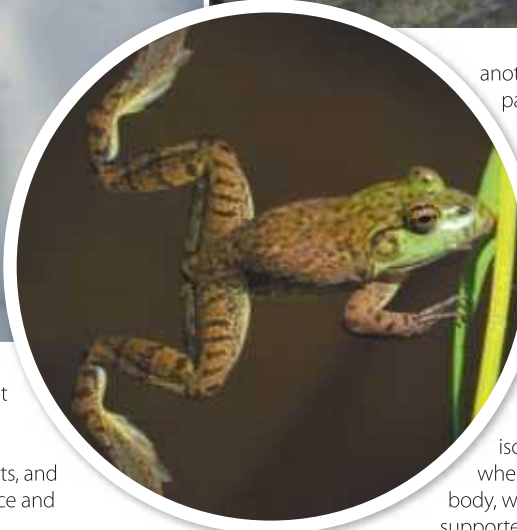




An albino form of the American bullfrog.  
Photo courtesy of the author.



The yellow colouration on the underparts is particularly clear when an American bullfrog is displaying and calling.



▲ The striped patterning that has led to these bullfrogs being called 'tiger toads' can be clearly seen here.

another to create quite outstanding patterning.

### Variable colouration

Some individuals are more colourful than others, often exhibiting lime green streaks which gradually recede into a buff brown. Captive-breeding has led to an intensification and refinement of the colours in domesticated strains.

The head is relatively large in isolation, but is still quite small when compared with the rest of the body, which is like an obese tennis ball supported on disproportionately spindly legs. Set in the head are a pair of quite small eyes, above which are soft, raised fleshy projections resembling horns, from which the toad derives its name.

As there is quite an imbalance between body size and leg length, this frog is not the most agile of species. In fact, once it

think that it is the most attractive member of the group. Its body is green or brown and adorned with darker spots or mottling. The underbelly is a creamy-white, often with a few black patches.

One of the most distinctive features of this bullfrog are its striped legs, which are powerhouses capable of propelling the creature over some considerable distance in one giant hop. These stripes range in colour from green to black, and are present on both the fore and hind limbs. This characteristic feature has given the bullfrog its alternative name of 'tiger toad'.

Unsurprisingly, the head is large with a rounded snout and large eyes that sit perched on top of the head like marbles. The eardrum, also called the tympanum, is equal in size to the eye, although it is slightly larger in males.

As with the other species mentioned so far, the mouth is massive, extending from one tympanum to the other, giving the amphibian a rather comical grin. This bullfrog is capable of swallowing prey almost as large as itself, which is quite some achievement - and this can include others of its own kind.

### Aquatic lifestyle

The American bullfrog is highly aquatic by nature, frequenting lakes, ponds, irrigation ditches and marshes, where it lies in wait amongst the vegetation for some unsuspecting creature to pass by. It is a

solitary bullfrog that is both diurnal and nocturnal, typically hunting large insects, and rodents such as mice and small rats.

At the start of the breeding season, the male begins to call for females with a 'song' that is often described as sounding like someone shouting 'jug-o-rum, jug-o-rum'. When spawning, a female will lay up to 20,000 eggs in huge floating masses. Such can be the scale of matings in communal breeding ponds that the surface of the water can soon resemble a giant bowl of semolina.

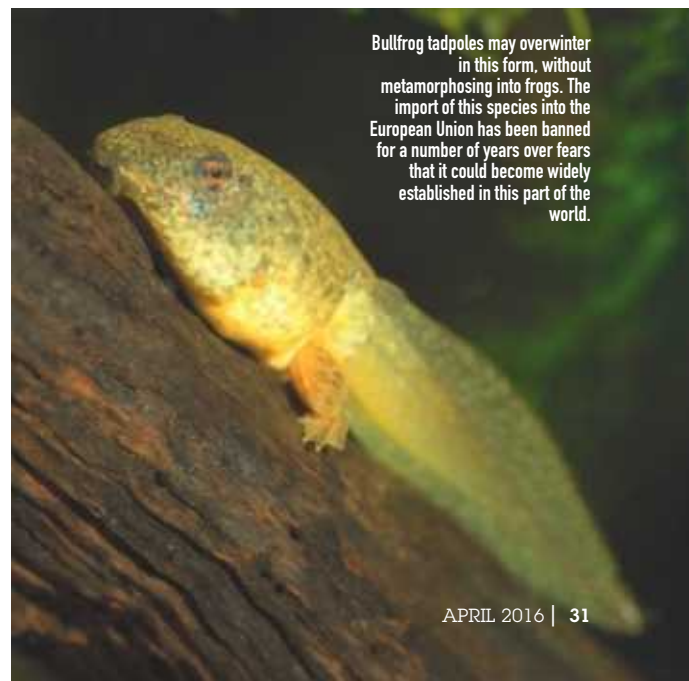
### ■ Horned frog *Ceratophrys* species

**Family:** Leptodactylidae.

This is another attractive frog, with eight species in its genus. Cranwell's horned frog (*C. cranwelli*), the ornate horned frog (*C. ornata*) and the Surinam horned frog (*C. cornuta*) are most commonly kept in collections. The overall range of the genus extends from southern parts of North America down as far south as central South American.

Horned frogs typically measure up to 17cm (6.7in), which means that in terms of size, they represent the smallest species covered here. Their body is typically a wonderful arrangement of browns and greens which intermingle with one

Bullfrog tadpoles may overwinter in this form, without metamorphosing into frogs. The import of this species into the European Union has been banned for a number of years over fears that it could become widely established in this part of the world.







has shuffled its way into a comfortable depression in the soft leaf litter, it will remain there for days, if not weeks on end, waiting patiently for a meal to pass by, which can then be grabbed with minimal effort.

## Keen predatory instincts

*Ceratophrys* seems to have one purpose in life, and that is to cram as much food into its huge stomach as possible, which it does with great enthusiasm. The mouth is massive, extending to well beyond the line of the eye, and is capable of dealing with large insects, small rodents and even immature individuals of its own kind. The appearance of its mouth also helps to explain why these amphibians are also known, particularly in the USA, as Pacman frogs, being so-called after the popular video/early computer gaming figure.

They have even been observed to tackle venomous snakes. The saying that if it crawls, slithers, or walks, it will be viewed as being fair game is definitely true in the case of these amphibians. They are masters of disguise, ready to ambush the unwary.

## ■ African bullfrog *Pyxicephalus adspersus*

**Family:** Ranidae.

Measuring approximately 20cm (8in) in length, this African frog is another goliath of the amphibian world, although it is not as colourful as the horned frog. It is a uniform dark green or brown in colour, with a series of longitudinal, raised ridges running along the back. The underside is a creamy-yellow, which becomes quite bright beneath the throat and legs. Juveniles are slightly more colourful than adults, often displaying a pale yellow colour.

It is difficult to sum this bullfrog up, although it can best be described as a deflated football. With its stumpy legs, small head and colossal mouth, it is essentially little more than a stomach on legs. As with the

➤ The colouration of horned frogs is highly individual.



▲ A close-up showing the eye and the 'horn' of the horned toad.

➤ Once it is partially buried, the markings of an African bullfrog can provide good camouflage in these surroundings.  
Photo courtesy of the author.

▼ The mouth of horned frogs is enormous, making them formidable predators, aside from giving them a cute appearance!



horned frog, so the African bullfrog shuffles itself into a depression, where it lethargically waits to ambush anything that it considers remotely edible which strays within reach.

Insects and earthworms form the staple part of its diet, but adult mice are dispatched with just as much ease. Again, snakes will be caught too; whether venomous or not. I have watched African bullfrogs taking on hatchling puff adders.

Needless to say, this amphibian also possesses cannibalistic tendencies. I have also known a few keepers who have, somewhat stupidly, poked their finger too close to the toad's mouth and then been forced to walk away in search of a much needed plaster.

Parental care is unusual in this bullfrog, with numerous documented reports of adults standing guard over their eggs to protect them from predation, only to eat the tadpoles themselves in due

course. It's almost as though they are nurturing their young for an easy meal!

## Captive care

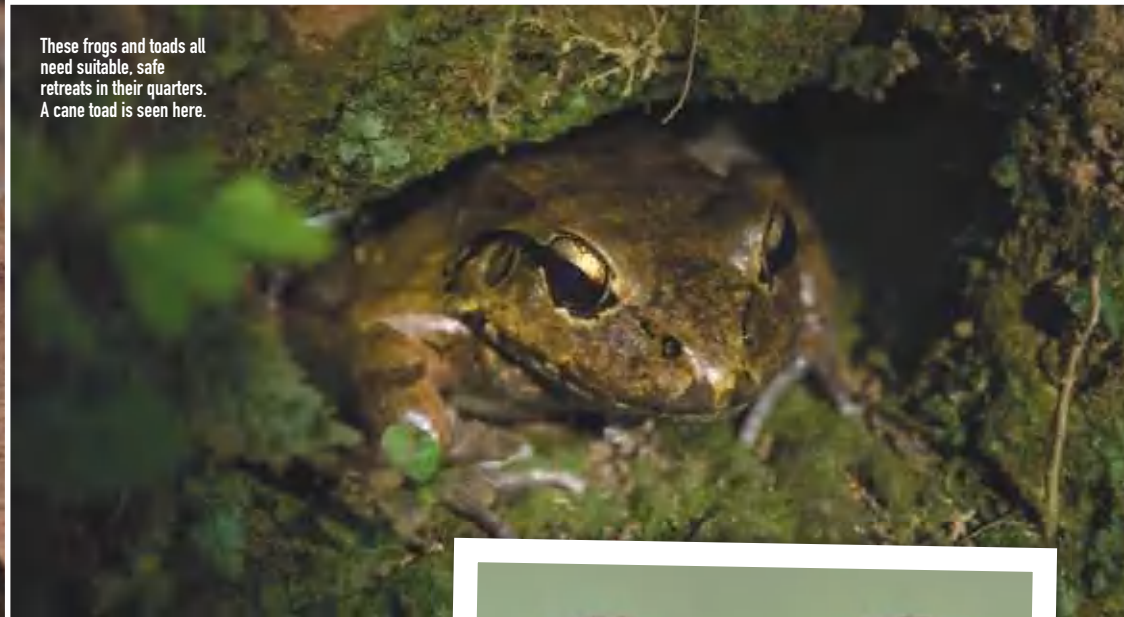
Despite their sizes, none of the species mentioned here require huge spacious living quarters. For the most part, a 60cm







These frogs and toads all need suitable, safe retreats in their quarters. A cane toad is seen here.



(24in) aquarium will be more than adequate.

The substrate should consist of a layer of 5mm (0.2in) aquarium gravel, topped with sphagnum moss, mulch or leaf litter. This will not only retain moisture but will also allow individuals to burrow down into the substrate if they wish. A few alternative hiding places in the form of pieces of cork bark, a broken plant pot or two, and one or two plants will help to complete the enclosure, which obviously also needs a secure ventilated cover.

One essential requirement for all is a large water bowl of sufficient size to enable those more aquatic species to submerge themselves fully here, should they so wish. In addition though, care should be taken to ensure that the individual can clamber out easily from the water bowl in due course. Those with shorter legs will find it difficult to escape from a deep water container, and thus they may benefit to a greater extent from keeping the substrate - or at least part of it - particularly moist.

As for lighting, if the level is kept quite low, this will encourage the amphibian to

be more active during the daylight hours. Some form of heating will also be required - sufficient enough to provide an ambient temperature of around 18-25°C (65-77°F) depending on the species.

### Feeding

Clearly, there should be no problems in this area, with members of this group being opportunistic hunters. A variety of invertebrates ranging from crickets, locust, beetles, spiders and earthworms, through to mammalian prey such as pinkies, fuzzies, adult mice and small rats will be eaten with enthusiasm.

As always, dust prey items with a vitamin and mineral supplement and then a calcium powder, alternating this arrangement. The invertebrates must also be gut-loaded using special food to maximise their nutritional value, up until the point that they are needed. Care must be taken though, as already mentioned, not to over-feed, as obesity can shorten the lifespan of these amphibians quite



▲ With such large mouths, this group of amphibians is capable of taking relatively big prey.

▼ All these large frogs and toads can inflict a painful bite, so beware! This is an African bullfrog.

significantly. This problem is especially likely to arise with the regular provision of mammalian prey.

### Tail end

If you are looking for an amphibian with a degree of character, then any one of these giants would fit your criterion. Do, however, keep your fingers well away from their mouths, because otherwise, they will be likely to pay back your inquisitiveness with an enforced visit to the first aid box! ❖



An African bullfrog displaying an unexpected turn of speed. They have short, stocky legs.





# REPTILE FOCUS

## Plated leaf chameleon (*Brookesia stumpffi*)

This small chameleon is found in parts of Madagascar, and on some of the small offshore islets too, such as Nosy Be and Nosy Komba, with its distribution localised to the north-west of the main island. Here it inhabits rainforest, where its appearance acts as a perfect disguise, enabling it to conceal its presence. It can also be encountered in areas of dry forest, and disturbed secondary growth.

The plated leaf chameleon measures just 9cm (3.5in) when adult. It spends its time combing the forest floor for invertebrate prey during the day, and then retreats up into the branches at night, climbing to a height of around 80cm (31in) off the ground at this stage.

There has been a lot of confusion over its scientific name, which it was originally given by the German zoologist called Oskar Boettger. It has since been renamed six times, but once again, it currently retains the original name that he gave to the species when he described it back in 1894.

Boettger himself was a keen herpetologist, whose name is incorporated into that of the eastern subspecies of Hermann's tortoise (*Testudo hermanni boettgeri*). It is also commemorated directly in both Boettger's wall gecko (*Tarentola boettgeri*) and Boettger's dainty frog (*Cacosternum boettgeri*). He lived from 1844 until 1910, and was afflicted by acute agoraphobia for much of his working life. This meant that he was reliant on museum staff bringing specimens to his home, so he could work on them there.









# Outdoor enclosures for reptiles



With the imminent arrival of spring, now is a good time to turn your thoughts to summertime accommodation for your reptiles. Here are some ideas and tips from James Brereton MSc.

**W**ith cold, wet winters, the UK climate is unfortunately not suitable for accommodating reptiles outside all year round. During the summer, however, reptiles can be kept outdoors for much of the day when the weather is fine and dry. This should bring both physiological and behavioural benefits for your pet, providing a potentially much larger environment which it can explore and investigate. Housing of this type may also reduce your running costs for heat lamps and lights at this time of year, helping you to save money on your electricity bills.

To make matters even better, outdoor enclosures can often be assembled quite cheaply, sometimes even from recycled materials. They can also be planted up with vegetation in some cases, which will provide valuable variety in your pet's diet. This article will cover both the benefits and disadvantages of outdoor enclosure, and give some guidance toward building your own.

## Outdoor enclosures & reptiles

In some warmer climates, such as southern parts of North America, reptile

hobbyists are able to keep their collections outside throughout the year. In addition to keeping down costs, housing reptiles outside can bring some real benefits for the health of your animals. Unfortunately, temperatures in the UK, and the climate generally is only suitable for reptiles to be placed outdoors from April to September, and even this does depend upon the weather on a day-to-day basis.

In virtually all cases, it is advisable to bring your animals back indoors as the evening draws in. Many of the reptiles that we keep should not be left outdoors overnight, as temperatures may drop too low, causing them to become chilled and at risk of respiratory infections. Furthermore, it is more difficult to prevent predator attacks or theft at night.

## Benefits of outdoor enclosures

Exposure to natural sunlight brings both behaviour and health benefits. Natural sunlight contains a full spectrum of light waves – from infrared light, which reptiles can absorb as warmth, to visible light, and of course, the all-important ultraviolet (UV) light. UVB light is key for the synthesis of vitamin D3 in the skin of both reptiles and



▲ Heavy rain may saturate grass in the garden, turning it into a potential mud bath.

humans.

Without sufficient vitamin D3 levels, reptiles can develop metabolic bone disease (MBD), which causes bones to lose their calcium supply and become spongy, to the point of making it difficult for the animal to move around. Access to the full spectrum, in the form of sunlight, can help your animal to remain in good health. (For a full review of the importance of UV light, please see the recent Baines *et al* (2016) paper at the end of this article).

Access to another specific type of ultraviolet light, known as UV-A, has been linked to the expression of natural behaviours in several reptile species. Some





▲ Green iguanas can also benefit significantly from being outside on hot, sunny days in a suitable run, especially as they are vulnerable to MBD.



▲ Don't forget that chameleons need aviary-type structures with branches. In fact, an aviary can be used for this purpose.

species are able to see UV-A, and can recognise their prey and potential mates by using their ability to see this light. UV-A is therefore regarded as an appetite stimulant and again, it is a natural component of sunlight. In bearded dragons (*Pogona vitticeps*), for example, many natural behaviours may suddenly be expressed when the animal is exposed to natural sunlight.

Another real benefit to outdoor enclosures is space. Indoor reptile enclosures are often limited by the size of your room: it can be quite difficult to find space to fit a 1.8m (6ft) vivarium inside a small home. Outside, on the other hand, large enclosures are much easier to accommodate.

Many reptile species, particularly tortoises, will make use of this extra outside space, and may get involved in new behaviours such as foraging and burrowing. In other cases, outdoor accommodation can be set up with branches to serve as basking spots, corresponding to the behavioural biology of your pets. Bearded dragons, for example, often seem to make use of branches placed in their enclosures in order to bask and warm up.

If your enclosure is placed on a lawn or contains plants, natural foraging behaviours may quickly ensue. Like others of its kind, Horsfield's tortoise (*Agrianemys*

*horsfieldii*) will devour plant shoots as they come into season, when kept under this system. Clovers and dandelion are popular with these reptiles, adding nutritional benefits to the list of advantages of outdoor enclosures. Again, fresh food eaten in outside enclosures can also help to minimise the costs of reptile keeping.

A rather under appreciated benefit of outdoor enclosures is that they can help to keep reptiles relatively cool. This may sound strange, but various chameleons, especially those from mountainous areas

in particular, do not like being kept too hot. Outdoor enclosures can therefore bring many benefits for reptiles. As with most forms of enclosure, however, there are equally some potential disadvantages that need to be taken into account.

Invertebrates may be hunted down by some species such as the bearded dragon. While this is an excellent method of improving activity levels for your reptiles, keep in mind that some wild invertebrates may contain parasites of various types, and they represent a potential danger to pets as a result. Where possible, keep your dragons away from snails, as these invertebrates frequently contain parasitic worms which could endanger your pet's health. Screening for parasites is important in reptiles that are free-ranging outdoors.



Tortoises will forage for food outdoors - ensure no potentially harmful chemicals have been used on this land.



Tortoises should not be allowed to mix with dogs or cats. They can also face additional predators outdoors.

## Seasonality

Outdoor enclosures may only be suitable for use in the UK for 6-7 months each year - perhaps even just for a shorter period of time in the far north. For a significant period of the year therefore, enclosures of this type will simply take up space in your garden shed or on the lawn. Nevertheless, the multiple benefits are likely to outweigh this disadvantage, and if they are sectional, they will be easier to store.

## Predators

In the UK, a whole host of seemingly harmless animals can prey on unprotected reptiles. Domestic cats and dogs may be friendly towards humans, but there have been reptile mortalities and serious injuries caused to reptiles by both of these domestic pets.

Rats and foxes have also caused the deaths of sleeping and hibernating reptiles, while foxes can be active predators too. Many wild birds such as crows and gulls are also quite capable of causing harm to our reptiles if left unattended, by seizing young tortoises as prey and flying off with them.

A well-built, solid enclosure should serve to keep your reptile protected against many of these threats. For smaller reptiles, a wire mesh roof is a critically important part of the design. This will protect your pets from airborne attacks, and also ensures other animals cannot get into the enclosure.

If this outdoor housing is to be used for long periods of time, the perimeter enclosure fence should be reinforced. This can prevent rodent species from burrowing into your enclosure. Moveable housing also needs to be relatively heavy, so it cannot be tipped over or moved by a determined fox for example.

Some larger tortoises may not need a wire mesh roof to keep them protected from cats or birds, but keep in mind these reptiles need somewhere to hide away from poor weather conditions, with a suitable dry retreat being essential in their quarters.

## Preventing escapes

Outside on warm days, reptiles may become surprisingly athletic. Their enclosures need to be reinforced to take into account this extra capability to escape. Bearded dragons, in particular, are able to climb some distance up vertical wooden surfaces. The walls of your enclosure therefore need to be high enough so that your reptiles cannot leap out. If you are using wire mesh, make sure this is carefully connected to the wooden frame on all sides of the enclosure,

▲ House your tortoises out of view of people passing on the road outside your property, preferably round the back of your home. These reptiles are a target for opportunistic thieves.

► Do make sure also that you can move your pet in and out of its enclosure without a risk of it escaping. If in any doubt, transfer it in a secure carrier.







resulting in an aviary type structure.

For digging and burrowing species, the lower part of the enclosure wall is of key importance. Make sure that your animals cannot burrow their way out. If you see burrows beginning to develop, make sure you fill these in immediately with stones, or move your enclosure. Reptile enclosures can be left unattended during the day, but they must be carefully monitored on a daily basis to make sure that no escape runs are developing.

### Species for outdoor enclosures

With their solar panel shells, tortoises are well-suited to benefit from being kept in outdoor enclosures, being well-placed to benefit from the sun's rays. It is not just the typical Mediterranean species such as Hermann's (*Testudo hermanni*) and Horsfield's tortoises, but also some larger species such as the sulcata (*Geochelone sulcata*).

When constructing your enclosure, make sure you take into account your pet's particular abilities. Species that burrow will need reinforced flooring. Large tortoise species will need well-constructed enclosures that can withstand some pressure above ground as well.

With regard to lizards, the bearded

dragon is one of the most commonly represented species in outdoor enclosures. These medium sized reptiles make use of their larger outdoor runs by increasing their activity levels considerably. Some of the bigger skink species, such as members of the blue-tongue group (*Tiliqua species*) may also be suitable to be housed in this way at times.

Geckos are notorious for their fast movement and small body size, which makes them adept at finding any gaps in their enclosure. Many are also crepuscular by nature, so they do not naturally make use of the midday sun. As a result of their athletic abilities, tiny sizes and the risk of predation, geckos are not generally suitable for outdoor enclosures.

### Constructing your own enclosure

It is not just a matter of building a suitable outdoor accommodation. Firstly, you will need where to locate it. Take account of the microclimate, and choose a location out of the direction of the prevailing wind. It is worth stressing that the area needs to be as sheltered as possible, as this will keep the temperature up.

Outdoor enclosures for reptiles can be constructed from recycled wood and wire mesh. Before you start, make sure you



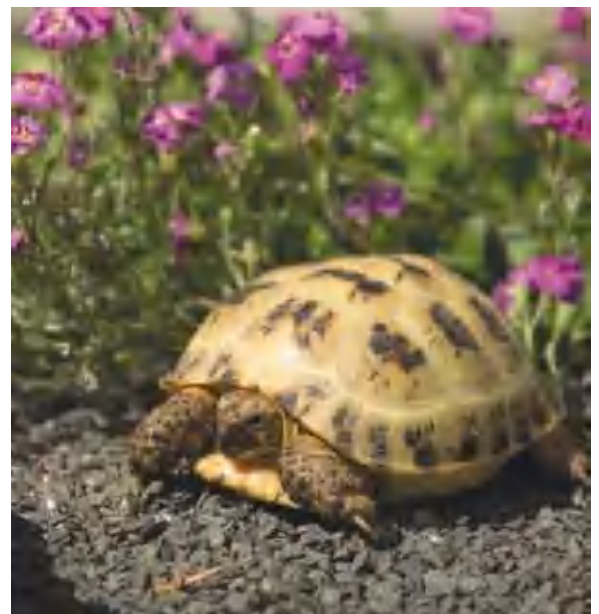
▲ Chipboard tends to disintegrate in the rain. Choose suitably robust materials for outdoor use.

source wood that contains no potentially dangerous chemicals. If you are buying materials, chipboard is cheap and easily available at hardware stores. It is often made from recycled sources, being reconstituted from small chunks of used timber.

Chipboard is an easily worked material that can be easily sawed into usable portions of wood, but beware. Items made from chipboard have a limited lifespan though: they quickly deteriorate if left outside during the winter, and so using this material can prove to be a false economy.

If you have a larger budget for your reptile's enclosure, a brick or block-based construction will last significantly longer. Bricks can be bought at builder's merchants: along with cement to hold them together. Good foundations are essential, and make sure the cement has dried completely before placing any reptiles in the enclosure. Keep in mind that some lizards may be able to scale a brick wall with ease, so roofing material must not be overlooked.

▼ Adding paving or dark gravel in an area that will heat up quickly will be appreciated by a pet tortoise, who will absorb the warmth through its shell.







When planning an outdoor enclosure, ensure that you design the layout on paper first. Here, you can decide upon the style of the enclosure, and the size it will need to be. Write down all your suggested dimensions for the structure, and make sure they all add up at this stage. This will also act as a shopping list of what you need to purchase.

Your measurements should be reflective of your own animals' particular requirements. If you are planning on housing a bearded dragon in a set-up of this type, measure the distance from your dragon's snout to its hind legs. Add a further 20cm (8in) which will reflect the likely distance that your dragon could jump on a hot sunny day. Make sure that these measurements are incorporated into the height of your enclosure walls.

For tortoises, enclosure walls need to be the taller than the full length of your tortoise. Many tortoises grow gradually but constantly throughout their lives, so it may be advisable to increase the height of your walls a little at the outset to accommodate future growth, or you could add another course of bricks later.

If walls are too low, tortoises may try to climb up, and are then likely to topple over upon reaching the roof. Should they land on their backs and then cannot right themselves, they will at risk of dying from heat stroke.

With regards roofing materials, ideal types of roofing should let natural light in while also keeping predators out. The cheaper forms of roofing that fit these requirements are types of wire mesh. Chicken wire, for example, has only small gaps but also allows good levels of sunlight into an enclosure, and can be used for this purpose.

Wire mesh of this type can cause damage to a reptile's claws, and so ideally, the roof should not be within reach of your pets. You can use support beams in the middle of large enclosures to keep the wire mesh from sagging, as may happen if a fox decides to rest here.

▲ Be sure the walls of the enclosure are tall enough, to contain a tortoise as it grows. These giant tortoises were photographed in their enclosure in the Seychelles.

▼ Basking in sunshine helps to keep a turtle's shell in good condition, and they will stretch their legs out in this characteristic posture out of the water at this stage.

## Shelter needed

UK weather can be unpredictable, and rain is very much a normal component of our summers. With this in mind, make sure there is somewhere where your reptile can hide away from rain or indeed very hot sun. A small section sheltered by wood or branches may suffice. If branches are used, this shelter may also double as a basking spot for lizard species.

If placing branches for basking, make sure these are not too close to the top of your enclosures. When kept outdoors, bearded dragons are notorious for leaping from their basking spots at the top of their enclosures. Allowing your lizard to get its claws stuck in the mesh could be a disaster.

Planting plants inside your enclosure can be an excellent method of increasing your reptile's activity levels. For many herbivorous species, UK lawns can be full of edible plants.

In hot, dry weather, water is yet another important component of any outdoor enclosure. A small pond can easily be added in, perhaps in the form of an Exo Terra™ bowl. If your reptile enclosure is going to be a long term investment, ponds may be created using concrete or other materials. As always, make sure your reptile is easily able to climb out of any ponds you include. Large clean pebbles may be helpful for this purpose. A larger secure pond will be ideal as a summer retreat for North American sliders and various other semi-hardy turtles.

## Waterproofing

Even during the summer, your outdoor enclosure will probably still be exposed to a lot of rain. This can cause wood to swell and deteriorate rapidly. Thankfully, there are a range of different products that can serve to protect the enclosure over the summer, and during cold winters when it will be unoccupied.

Wood paints and varnishes add a waterproof layer to your enclosures, fighting rot and prolonging the life of the structure. As always, make sure that all of the products you use are non-toxic to reptiles, and are completely dry before any

reptiles are allowed into an enclosure of this type.

Roofing felt may be used on any surface where water might settle - typically the roofs of shelters. It can be applied easily using special nails. If you need to overlap roofing felt, always place the top layer so it extends down over the lower layer, to prevent rain running back under the felt to reach the wood of the roof. Special tape can be used to seal overlapping areas too, and this should prevent the felt itself being torn off in high winds.

In order to extend the life of your outdoor run though, storing wooden enclosures of this type in warm, dry places (such as a garage perhaps) over the winter is highly recommended. Wood deteriorates slowly if kept dry, so keeping your enclosures indoors in the winter can really make a difference - and save you more money! ♦

## Further information

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# Keeping and breeding dragons

All photos courtesy Fire and Ice Dragons.

Terri Sommella from Fire and Ice Dragons in the USA is passionate about breeding bearded dragons and was delighted when her super citrus colour morph was named as the best morph to have emerged over 15 years. Here in the first of a two part series, Terri speaks to Susie Kearley about her passion.

**B**earded dragons are one of the most intelligent of all reptiles and easy to care for," enthuses Terri. "Beardies have individual personalities and are remarkably intelligent, with a strong capacity for learning.

## Dog-like characteristics?

Is it true that they can bond with people with the same intensity as a dog or cat? Terri is in no doubt, but qualifies her reply. "Yes, but this characteristic is most apparent when the dragon reaches

## ▲ Nugget Super Citrus.

sub-adult or adult age, and is no longer in pure survival mode, running away from everything at warp speed as youngsters will do. Once a bearded dragon is older, it is higher on the food chain, less afraid of being eaten by predators and will generally



calm down."

What can an owner expect though, who may not have kept a lizard before? "We have adult dragons that love to hang out with us while we watch television for example," says Terri. "They will sit on our shoulders while we enjoy the summer sun on the patio. Some appreciate praise, respond to their names and like having their heads scratched. They are all individuals, but every one of our beardies will respond to gentle human interaction."

## Breeding bearded dragons

"We are a small, exclusive breeder. Our facility is only 93 sq m (1000 sq ft). Our business model was to breed the healthiest, most beautiful dragons in the world while also having the time to be accessible for front-end and long term coaching for actual customers," explains Terri.

"To achieve this aim on the breeding side, we may keep eight super citrus babies for breeding, but then select just two or three of the best specimens, which meet our strict criteria for breeding, when they grow up. We will sell those that do not make the grade or retire them to our home."

Does Terri see any problems associated with the emphasis on colour-breeding that has become so prevalent? "Many breeders have become myopic about colour and forget the other assessments such as vigour, size and conformation (a perfect balance of head, neck, body, tail and legs)," she replies forcibly.

"If you focus only on colour, you can end up with dragons that are too small, which may also have congenital health problems and therefore, have a short and unhealthy lifespan. It is a common problem. Only dragons that meet our criteria make it into our breeding programme."

▲ Fire red leatherback juvenile.

▼ One of 12 racks in the baby room in Fire and Ice's facility. Wheels on the racks mean they can be moved around and the room kept sparkling clean.



## Starting out to breed them

What advice would Terri therefore give to someone starting out to build up a breeding collection? "The number of breeding dragons we have at any one time is quite fluid. We retire some breeding dragons and bring new ones up. The most important thing is to know how many dragons you can keep healthy. This can be driven by the number of cages that can be accommodated in the available space, or the number of people involved. We set a certain number and stick to it.

"When we started, 15 years ago, I asked someone in the industry if they had any advice. She told me to always take care of your breeding dragons first. She was right," Terri adds.

How has Fire and Ice Dragon's bloodline evolved since then? "We are a bit unique in that we breed mostly purebred lines, meaning citrus to citrus going back many years. To do that, we had to take the long view. When we first started, we knew we needed to keep a gene pool large enough to breed in this way without inbreeding. As an example, in this case, we have three different citrus lines.

"Various colours or patterns will interbreed if they are placed together. We keep males and females apart until we determine which dragons we hope to breed that season and then introduce them.

Why do some people get such

disappointing results, in terms of the colours that they produce when breeding from their bearded dragons? "Most hobby breeders purchase a dragon here and there, and then put them together to breed. With such mixed genetics, you can get plain beige looking babies, babies that have colour but grow up to be beige adults, or sometimes, come up with something new," explains Terri. "Super citrus are my favourites. I think they are absolutely gorgeous! After all this time, they still strike me as stunning.

We produced a super citrus purple paradox translucent from a purebred ice bred to a purebred citrus once. It's exciting - but accurate record-keeping is absolutely vital in providing a road map to give you the best chance of success.

## Housing and management

"Our adults are kept in enclosures made from white melamine measuring 1.2x0.6x0.45 or 0.6m (48x24x18 or 24in), in terms of length, depth and height," says Terri. "Tests here showed that this type of set up made the dragons happiest. This group were the brightest in colour, ate the best and bred the best. I suspect this has to do with the highly reflective surface of the white melamine which creates a very bright enclosure. The light in Australia, which is the bearded dragons' natural home, is very bright.

"We keep babies in bins in a rack. We





also house them individually rather than piled together. This provides an environment which is closest to their natural preference. In the wild, babies hatch and go their separate ways. They are very territorial by nature.

"Our babies are fed crickets, phoenix worms, dubia roaches and high calcium dark leafy greens. Adults are fed a wider variety of insects, as well as greens with a high calcium content, plus veggies and

fruits. We grow most of the food for the dragons so we feed what is in season. But an example of a summertime daily menu would be green beans, okra and acorn squash. There is a food chart on our website which has a comprehensive list," Terri explains.

"Every time we find new eggs or hatchlings, it's thrilling! It's always a big event around here. Some hatchlings have strong personalities right out of the egg. I remember one that hissed at me! He was not being mean, just very bold!

"No two bearded dragons are the same. They are all unique, being similar to dogs. Many like strawberries, but certain individuals hate them. Some prefer their bath water very warm. Others like it cooler.

▼ Eggs are incubated in suitable containers, and carefully monitored right through until hatching.



▲ The eggs of bearded dragons are leathery and white in colour. Hatching typically occurs after an incubation period of about 65 days.

They each have a preferred basking temperature. A number are highly intelligent. Some are pretty chilled out. Most of ours know their names by the age of two and react when you call them. They are infinitely fascinating and I do not think I will ever tire of watching them."

### Caring for bearded dragons

"Juvenile bearded dragons can be quite territorial and surprisingly spiteful, in our terms," admits Terri with a chuckle. "You can get one that sits on a fellow cage mate preventing him or her from eating or drinking. If more than one bearded dragon has found its way to your heart or home, keep the dragons in separate cages where they cannot see each other, especially during the dragons' adjustment period.

"As adults, this social hierarchy presents few problems so we can house adult females together often. This is one way to observe the behaviour of 'arm waving', which is an endearing characteristic.

"Health checks are important, so get some scales, and keep accurate weight and feeding records. This will alert you when something isn't quite right, and enables you to correct the issue hopefully before it becomes life-threatening. Good husbandry and frequent informal health checks will keep your dragon happy and healthy for many years," advises Terri.

"Before brumation, which occurs typically during the dragon's second year, it is advisable to have a qualified reptile vet check a stool sample. Faecal checks can alert you to any parasites before the dragon enters a sleepy phase and is most vulnerable to parasitic attacks. Just as you worm a puppy, you will probably need to worm your dragon at some point in its life."







How are your young bearded dragons reared? "For housing, a 20 gallon long aquarium is usually adequate to house a 15cm (6in) juvenile for a few months. This size is long enough to allow a proper temperature gradient but small enough for the juvenile to locate prey items easily," explains Terri.

"As your dragon grows, it will require a larger enclosure. We use white cages, vented in the back with clear sliding doors. They're easy to clean and keep valuable UVB and bright, visual light inside the cage rather than spreading it through the glass walls of an aquarium. The cages are also able to withstand the high temperatures of the basking light without melting the structure.

## Cleanliness

How about the substrate for young dragons, as this is a controversial area? What would Terri recommend? "As a substrate, we use white Repti-Sand from ZooMed for adults, and paper towels for juveniles. Repti-Sand is super fine and doesn't need to be pre-sifted," she explains. "Various other sands and substrates have created well-documented impaction problems. We use paper towels exclusively due to the ease of clean up for us and hygiene for the dragons.

"Spot clean faeces immediately and disinfect the cage thoroughly once a week. Cleanliness now will save you many headaches in the future. We use one part original strength bleach to 30 parts water to clean. Rinse well and dry. We alternate with Novalsan, an anti-microbial, anti-viral cleaner used in zoos and veterinary clinics,"

▲ A male hypo ice leatherback.

▼ A section of adult racks in the breeding room. Dragons are housed in clean, 1.2m (4ft) cages with intense lighting.

adds Terri.

"In terms of cage furniture, juveniles benefit from a simple environment. A smooth, palm sized pebble or river rock, available at most garden centres, makes an excellent basking rock. We use dark rocks which hold heat well and aid digestion.

"Do not under any circumstances use heat rocks or heating pads, which might burn a dragon's sensitive belly. The only items in our juvenile bins are a basking rock, water dish and a small feeding dish. That's it!" advises Terri. "Otherwise, prey items will crawl under logs and branches where the juvenile cannot locate them, then come out and bite the helpless youngster. You will have plenty of time to

design an elaborate habitat when the dragon is old enough.

## UV lighting

"Your dragon will need full spectrum UVB light. We use Zoo Med's 10.0 UVB Reptile light and a fluorescent type fixture that runs the length of the cage. This UVB bulb performed the best in our tests against all other UVB lights," advises Terri.

"UVB only penetrates approximately 30cm (12in) from the source. Make sure the UVB light is about this same distance from the floor of the juvenile dragon's cage. For adults, the UVB can be farther away. If the UVB light is older than three months or is too high from the floor of the cage, the





dragon will not be stimulated to eat and MBD (metabolic bone disease) can cripple the dragon.

What checks on the equipment does Terri carry out? "We check our UVB lights every six weeks with a Solarmeter 6.2. When UVB levels drop to 70% of burn-in levels, the bulbs are no longer in the therapeutic range and need to be replaced.

"The basking or heat fixture we prefer is the silver domed variety, also known as a clamp light. For the actual heat bulb, we use a standard clear household lamp bulb. You will want to buy several wattages and switch the light bulbs out while testing for the correct basking temperature bearing in mind the seasons change," Terri says.

### The importance of temperature

"The juvenile dragons generally eat best at 37-38°C (100-102°F), measured using a digital infra-red temperature gun. This gives you a completely accurate reading. We have seen other thermometers be off by as much as 5.5°C (10°F)!"

What about the actual set-up? "Do not use screen tops for aquariums, as we have found the tops block up to 30% of UVB rays as well as visual light. We either hang

the lamp above the bin or clamp the light on the side.

"The cool end of their quarters needs to be at 27°C (80°F) - taking your reading on the floor of the tank. If the temperatures are not correct, raise or lower the lamp or the wattage of the bulb you are using in the basking lamp until the temperature under the light on the bottom of the cage is correct.

Temperature mistakes can be fatal," says Terri.

Temperature and set up problems cause 90% of dragon husbandry problems in her experience, and are directly associated with lack of appetite. Bright light and correct temperatures stimulate dragons to eat.

### Understanding the process

What about managing the system to avoid problems? "For convenience, set lights on an auto-timer for 12 to 14 hours per day. A night-time drop in temperature to a normal household figure of 21°C (70°F) is fine and necessary. If your home is very cold at night, red heat bulbs can be used to bring the temperature up to the optimal night-time temperature. Be careful not to overheat the cage at night though. A night-time drop in temperature

is necessary for dragon health," advises Terri.

"Dragons wake up and bask to warm up. Light, heat and UVB stimulate a dragon's appetite and allow the dragon to digest his food. If the basking spot is too hot or too cool, the dragons will not eat.

"On the other hand, when a dragon's internal temperature becomes too hot, the dragon requires an area of the cage that is 11°C (20°F) cooler to get away from the heat of the basking lamp and thermoregulate. Being able to thermoregulate and adjust its body temperature is essential for a bearded dragon to survive. If it cannot cool off, the dragon will die," Terri adds. ❖



▲ Hypo fire red translucent leatherback.

### Further information

See the website  
[www.fireandicedragons.com](http://www.fireandicedragons.com)



**NEXT ISSUE:** Terri reveals more about feeding and handling bearded dragons.

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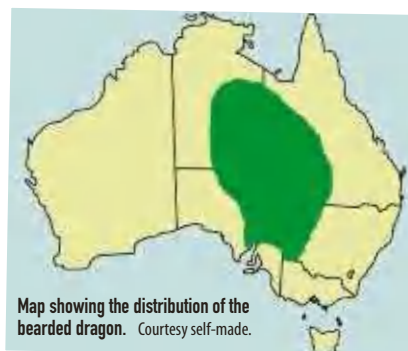


## DO YOU NEED A HELPING HAND OR ADVICE?

Email your queries to [prk.ed@kelsey.co.uk](mailto:prk.ed@kelsey.co.uk) or write to the address on page 66. A selection of submitted questions will appear here every month, and a prize of Vetark products will be awarded to the writer of the Star Question. Regrettably, replies can only be given through this column, and if you are worried about the health of your animal, seek veterinary advice without delay.



## Sleepy dragons



Map showing the distribution of the bearded dragon. Courtesy self-made.



**Please can you explain about brumation in bearded dragons?**

In some respects, reptiles are better equipped to survive a downturn in environmental conditions than mammals. Their energy requirements are significantly lower, as they are cold-blooded, and so they are less dependent on having access to a constant supply of food.

Bearded dragons originate largely from the central region of Australia. The climate there is hostile, being very hot and dry during the day, and falling away dramatically at night. In the more southerly parts of their range though, bearded dragons are exposed to greater variance of temperature through the year.

Cold weather at this stage will mean that plant growth is reduced, and there are fewer invertebrates available as well. A lower diurnal temperature also means these lizards will be less active during the day. They depend on the warmth of their environment to support their activity.

As a result, in order to conserve their energy levels until environmental conditions improve again, the lizards slow their metabolism down, and will hide away. This response is known as brumation – it is a completely natural behaviour, having evolved in reptiles over millions of years.

### In the vivarium

Bearded dragons in vivarium surroundings will sometimes start to behave in this fashion as well, which can be very alarming for an owner, especially if you have not encountered this situation before. A bearded dragon entering this state becomes lethargic, hides away and loses

interest in food – all of which could be seen as typical signs of illness!

It then becomes a matter of being able to distinguish between brumation and an underlying health issue that could account for such behaviour. This is where the experience of a reptile vet can prove invaluable, and a health check-up is always advisable if you are concerned about your pet's welfare.

Nevertheless, there are some pointers that can be suggestive of brumation, starting with the time of year. Speaking awhile ago with one of the country's leading breeders of beardies, it seemed pretty clear from our conversation that these lizards are sensitive to external pressure changes which affect our weather patterns.

Housed in a vivarium, they can register changes in day length through the year, and may pick up on temperature shifts too. Cases of brumation in bearded dragons tend to be most commonly reported during the winter, particularly when the weather is cold for any period of time.





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Clearly, in spite of being kept in a warm, well-illuminated environment and provided with adequate food in such surroundings, these lizards can still detect adverse climatic conditions in the wider world around them, with their bodies reacting accordingly.

It may be tempting these days, especially given the range of colours and the increasing number of scale types that now exist in bearded dragons, to see these lizards as long-domesticated pets. In reality though, they have only been kept and bred as pets on any scale for barely 30 years or so.

This is not even equivalent to a millisecond in terms of their evolutionary history. Unsurprisingly therefore, traits such as brumation that have served them well, ensuring their survival, have not yet been significantly diluted or even lost as the result of domestication.

### What you should do

Young bearded dragons tend not to brumate, so be suspicious of an individual in this group that appears to start showing signs. It is more likely to be suffering from a build-up of parasites or some other form of illness.

Brumation does not just occur in the winter though. It can occur in the summer, particularly during very hot spells of weather, as it is a reaction to any adverse change in the climate that could affect the lizard's chances of survival. Furthermore, as they originate from the southern hemisphere, this would naturally be the bearded dragon's winter.

So what should you do if your bearded dragon starts to brumate? Try to ensure that it remains adequately hydrated through this period. Make

sure that you offer small quantities of food with a high water content, and an occasional opportunity to soak in tepid water can be recommended.

Brumation lasts for a variable period of time – typically averaging around two months, but provided that you are sure that your pet is healthy at the outset, then this should not be a matter of great concern.



## Tortoise care after hibernation



**My Mediterranean-spur thighed tortoise has not hibernated well this winter. Does this mean that I should take any special precautions now that he seems to have woken up**

**permanently?**

One of the most important things that owners can do when it comes to keeping a check on their tortoise's condition is to weigh their pet regularly. Log this information, so you can refer back to it, as it will allow you to recognise when there is a potential problem.

With your tortoise having been reluctant to settle down and hibernate over the winter because of the generally mild weather, particularly in southern England where you live, the chances are that your pet will have lost more weight than usual. His increased activity levels may also have made him more dehydrated as well.

The key things now therefore are to rehydrate him, and to get him eating without delay, in order to build up his condition. What is often not realised is that it is in the first part of the year after emerging from hibernation that tortoises put on the bulk of their weight, rather than later on. This is why it is so important to ensure that tortoises start eating again as quickly as possible after emerging from hibernation.

Weighing your pet through the year is the only way that you can keep an effective check on its condition. Owners often assume that their tortoise is doing well when the time comes round for hibernation, because the reptile has been eating well in the early autumn, when there is usually a

new flush of plant growth. However, if it has not done well beforehand, then there could be trouble ahead during hibernation.

### An action plan!

The best way to rehydrate your tortoise at this stage will be to place it in a shallow container of tepid water, and fill this up around the side of the shell, allowing your pet to extend its head down into the water and drink easily. There are vitamin

outside drain – never down a sink on grounds of hygiene.

Set up warm indoor quarters for your tortoise at this stage, even if it is likely to spend more time outside in the summer. A combined heat-UV source is to be recommended, with the UVA component of this light serving as an appetite stimulant, while the UVB wavelengths stimulate calcium metabolism.

Offer your tortoise plenty of juicy foods, such as tomatoes and fresh dandelion leaves, sprinkling these with a vitamin and mineral powder. Assuming your tortoise is healthy, it should start eating again rapidly within a few days of emerging from hibernation, especially if bathed once or twice a day.

### Trouble-shooting

A particularly worrying sign can be if your pet sits with its eyes closed after a bath in a warm environment and shows little interest in its surroundings. Tortoises in poor condition have difficulty in keeping their eyes open, because the pad of fat that supports them normally is metabolised.

This effectively causes the eyes to shrink back slightly into their sockets, with the eyelids being more likely to cover the eyes as a result. Once a tortoise starts to put on weight again, this problem resolves itself, but it can be a question of persuading your pet to feed from your hand certainly up to this point, with the aim of rekindling its interest in food.

If, in spite of all your efforts, you find that your tortoise refuses food, you should seek veterinary advice from a specialist reptile vet within a week or so. The cause of the underlying anorexia needs to be identified and treated sooner rather than later, hopefully allowing your tortoise to recover more quickly.

*David Alderton*



supplements that you can add to the water as well, to give your pet a boost now, but always follow the dosage instructions carefully.

Choose a container that will be suitable in size to accommodate your tortoise comfortably. Keep a close watch on your pet here, because it may otherwise tip this over if it tries to get out, spilling the water as a result. Rinse the container out thoroughly after use, pouring the contents down an

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Mourning geckos are incredibly agile – and great escape artists.



## TALES FROM

# THE REPTILE HOUSE

## EASTER EGG ISLAND

Having worked for many years as the curator of a zoological collection in Scotland, Bill Lowe got himself involved in some strange situations, such as the case of a missing giant Easter egg. Here he also reflects on a particular species of gecko that always reminds him of Easter.

It was Easter Sunday and I was heading to work very early that morning. The windscreen wipers on my car had struggled to cope with the lashing rain and it was obvious that the festivities planned for the park that day were going to be a complete washout.

I felt particularly sorry for Sarah – one of the Special Needs youngsters who was employed as a trainee keeper. On Good Friday, assisted by two other members of my staff, Mick and Fred, she had thrown herself into the task of laying a trail of miniature chocolate Easter eggs around the paddocks, bird aviaries and other animal enclosures that surrounded the Reptile House.

She had even had the courage to berate her companions when she caught them each surreptitiously pocketing a handful of these tiny Easter eggs, peeling back the foil wrappings and popping

them into their mouths when they thought she wasn't looking.

As she announced in no uncertain terms to Mick and Fred, these Easter eggs were for the children visiting the park on Easter Sunday to find. And whilst I could have added that, very often, in terms of their behaviour, Mick and Fred both acted like a couple of overgrown schoolboys, they should have known better.

### Washed-out – time for plan B!

Now, all Sarah's gallant efforts had been swept away in the torrential rainfall, which heralded the storm that had broken early that Easter Sunday morning. She was due to arrive at work in about half an hour's time and I knew that she would be inconsolable when she realised that all her efforts were to be to no avail.

The Easter Egg Hunt was due to commence at 11 o'clock that morning and



▲ Sarah was in charge of planning the Easter egg trail.





even if the sun did manage to come out again, there would be barely time for a new trail to be laid. Besides, if the rain persisted, I wasn't sure if the local school children would have very much enthusiasm for following a soggy trail, even if they would be rewarded in terms of chocolate treats at the end of it. I had to come up with an idea quickly!

### Heading to the Reptile House

What I decided was that this year, the annual Easter Egg Hunt could be transferred under cover and that it would take place inside the Reptile House. Sarah was delighted with the idea that all was not lost, and threw herself into the task of saving the day with renewed gusto.

She headed off to the local sweet shop

to buy a new stock of miniature Easter eggs. Meanwhile, I sat down at my typewriter (this was long before the days of computers!) and set about the task of compiling a quiz based on identifying the different occupants of the Reptile House and how many (and what colour) Easter eggs were concealed around each of their quarters. This then had to be duplicated, to make enough copies.

Once Sarah arrived back, we busied ourselves filling the plastic boxes with a particular colour or a specific number of Easter eggs. The children would have to complete the questionnaire answering questions such as "Which species of snake was looking after six red Easter eggs?"; "Which lizard had two gold-coloured Easter eggs in its care?" and "How many

▲ The replica snakes weren't entirely convincing substitutes, when it came to guarding the egg.

▼ Red-kneed tarantulas were used to help!

Easter eggs was the Mexican red-kneed tarantula guarding?"

Now, of course there had to be a prize for the winner (apart from the egg which every child received for taking part), so Mick and Fred were summoned to erect a trestle table in one corner of the Reptile House, which was to be cordoned off out of reach from the general public and from the children taking part in the competition.

### Things seemed to be settled...

In pride of place was the giant chocolate Easter egg that was to be awarded to the winner. It had a guard of honour in the form of a selection of brightly coloured snakes, suspended for a selection of tree branches hastily gathered from the park. I should add that its defenders would not really have been much good in terms of providing protection though, as they were a selection of cuddly toys in serpentine shapes!

Meanwhile, figuring that I didn't have to play any further part in organising the event and knowing that Sarah was quite capable of handing out the questionnaires and explaining the basic concept of the competition, I retreated to my workroom behind the scenes in the Reptile House.

By this point too, I knew that Sarah would defend the giant Easter egg against all-comers and that it would remain perfectly safe from any would-be sticky fingered attempt to lift it before the end of





These huge ancient carved figures are a characteristic feature of Easter Island. They are also a good habitat for geckos!



the day. At that stage, I could announce the winner before a gathering of the local press for the final photo-call, which would give us some publicity.

▲ The location of Easter Island. This is one of the most isolated inhabited islands on earth.

## A new home

Besides I had work to do – I was setting up a new vivarium that was to house the newest addition to the Reptile House – a small group of mourning geckos (*Lepidodactylus lugubris*) – a species which, coincidentally, is one of only two lizards which occur on a particularly remote island in the Pacific Ocean – Easter Island.

These highly adaptable little geckos (alternatively known as the smooth-scaled gecko) originally arrived on Easter Island either by stowing away with early Polynesian settlers, or perhaps by means of floating across the Pacific on rafts of vegetation. No-one knows for sure.

However, tests have confirmed that mourning gecko eggs are extremely tolerant of salt water – so it is highly likely that they could have arrived on Easter Island not as adults, but as (Easter) eggs!

Either way, they could drift for long distances across the ocean on uprooted trees, or mats of vegetation washed out to sea by storms and subsequent flooding.

## Home to just two reptile species

Due to its extreme isolation, there are very few animal species on Easter Island. There are no snakes and only the two species of reptiles are found there – the mourning gecko (known locally as “moko uru-uru kau”) and the snake-eyed skink (*Cryptoblepharus poecilopleurus paschalis*) which is known locally as “moko uri uri”.

Easter Island is one of the most remote inhabited islands in the world with a current population of just under 6,000 of whom some 60 per cent are descendants of the aboriginal Rapa Nui civilization. The nearest inhabited land is the barely populated Pitcairn Island situated almost 2100km (1300ml) away.

It is located in the south-easternmost point of the Polynesian Triangle. It is most famous for its 887 gigantic statues, called moia, created by the early settlers, and it is now a World Heritage Site, with much of the island protected, including the Rapa



Nui National Park

## Spanning the globe!

Mourning geckos occur on all the larger Hawaiian islands (arriving there long before Europeans). They were the most common species of gecko in the Hawaiian Islands prior to the arrival of the common house gecko (*Hemidactylus frenatus*) during the Second World War.

The house gecko is a more aggressive

species and simply out competes both the more docile mourning and stump-toed geckos (*Gehyra mutilata*) when it comes to hunting and finding sufficient food.

More recently still, the red-vented bulbul (a popular species with foreign softbill enthusiasts in the UK and one which has deliberately been introduced from south-east Asia) has decimated populations of mourning geckos and



The house gecko is more aggressive by nature, and out-competing the mourning gecko where their distributions now overlaps.





▲ These geckos will often lay under tree bark.

The back is covered with thin, dark, wavy chevron markings separating lighter patches and the under belly is typically cream coloured. Hatchlings have more contrasting patterns and measure less than 3.5cm (1.5in) in overall length.

### Unusual breeding habits

In my opinion though, the mourning gecko is a fascinating little species, which has a number of unusual traits. Firstly, there is no need for a male for reproduction purposes, as the species is parthenogenetic.

In the wild, colonies of these geckos are comprised of females for this reason. Sexual maturity is reached once they are around nine months old, when eggs will start to be produced. Typically only a single egg will be laid (although, occasionally two eggs will be produced).

The mourning gecko is also unusual amongst reptiles in that it is a communal nester, typically laying in favoured locations, such as tree cavities, in leaf axils, or beneath loose sections of bark. Some females seem to adopt a dominant role, even displaying courtship-like behaviour. Typically, only the dominant animals will breed.

Remember that these geckos are cannibalistic though, consuming both eggs and hatchlings given the chance. Housed in a community, all the females will become reproductively active at the same time, laying their eggs concurrently.

### Breeding in vivarium surroundings

If eggs are produced in a vivarium, it may prove difficult to remove them to safety without breaking or cracking their fragile shells. An alternative solution is to tape a small, ventilated cup over the egg to prevent the hatchling from escaping, or being eaten by the adults. You can even use the base cut out of an egg box, with a hole punched in it in an emergency.

The incubation period lasts around 70 days. As soon as they are first observed, the hatchlings should be removed to alternative accommodation, making sure that this is totally escape-proof. They can squeeze their way through holes that one would not imagine possible!

◀ The introduced red-vented bulbul (*Pycnonotus cafer*) is now preying on these geckos.



other small lizards.

Elsewhere the mourning gecko ranges from Sri Lanka eastwards across tropical Asia, right across the Pacific to Mexico and parts of Central America. Individuals have also been introduced to parts of Australia – being particularly numerous in Queensland. As well as occupying more natural habitats in uninhabited areas, these geckos are quite commonly found in residential localities.

When translated, the word “lugubris” means of or pertaining to mourning. Other dictionary definitions include “disastrous”, “pitiable”, “doleful”, “plaintive”,

“sinister”, “mean” or “gloomy”, and certainly in one respect, the mourning gecko could be termed as appearing “gloomy”. Unlike some other geckos, it does not sport any particularly bright colours.

### Appearance

This short, slow-moving species appears to be rather stout, only measuring a little under 10cm (4in) in length as an adult. The skin on the back is satiny and lacks tubercles. There is a very characteristic dark line between the eyes, with another extending from the tip of the snout through the eye and on to the neck.



A day gecko licking nectar from a flower. Many species of gecko display a sweet tooth.

## Enclosure design

A suitable vivarium should be of the tall variety rather than providing a more typical horizontal "landscape" space, as mourning geckos are largely arboreal. Needless to say, the larger the amount of space you are able to afford to them, the more you should be able to house together. Ideally, I would recommend establishing a group of, say, half a dozen individuals, reflecting their communal nature.

You should install a number of vertical climbing branches. For this purpose bamboo is ideal, providing a natural climbing frame. I was lucky because in the adjacent park, I had access to all manner of more unusual plants with which to furnish the vivariums in the Reptile House.

I would also recommend installing a feeding ledge in the upper reaches of an enclosure for these geckos. This makes the routine provision of food and water much easier. In the past, I have successfully maintained these geckos together with poison dart frogs, and certainly in collections, they may well live for up to 15 years.

Remember that these little geckos are escape artists par excellence though. Fit your vivarium with a sliding screen top



◀ These geckos are very adept at finding small holes through which they can escape.

and make sure that it is closely fitting, as I have known juveniles to escape through the gap created by an ill-fitting lid, or even via the space surrounding a cable as it passes through a hole serving as a conduit in the roof of a vivarium.

## Management

Ideally, mourning geckos should be kept at a temperature between 21-27°C (70-80°F). In its natural habitat, this species will be exposed to moderate levels of humidity, so I would recommend 60% as a minimum requirement and certainly no more than 80%.

You should always allow the vivarium to dry out for a short period during the day in order to prevent the build-up of bacteria and fungi or moulds, and then you can spray it again, avoiding the electrics.

The species is more inclined to be frugivorous rather than omnivorous, with a variety of insects, fruit and nectar forming the mainstay of the diet in captivity. Suitable items of livefood include small crickets and cockroach nymphs, which should be dusted with a calcium supplement and added vitamin D3.

Feeding once a day is not necessary and, to a degree, might be considered detrimental. Instead, I would advocate

feeding on alternate days, with any uneaten food being removed more regularly.

Mourning geckos enjoy sipping nectar and in a domestic situation, they will happily crawl around a kitchen, licking small amounts of split fruit juice, or jam from kitchen worktops.

At other times, they will use their tongue to sweep it over their eyes. The long tongue is used like a windscreen wiper, cleaning dust and other particles off the surface.

## Handling

I would not recommend handling these lizards unless essential: their skin is very thin and will easily tear if they are subjected to slightly rough treatment - in the wild, the ability to shed a section of skin is a defence mechanism, allowing a potential victim to escape a would-be predator.

Mourning geckos are not a species that can be handled with ease in any case, as they are extremely fast and will readily escape from their handler's grasp. They are capable of gripping on to virtually any type of surface and can squeeze through the tiniest of apertures, making it almost impossible to capture one again if it manages to escape into a room.



Mourning geckos are not easily to handle. If they get out, try to steer them into a container or net, rather than trying to catch them by hand.

## The perpetrator finally unmasked

I decided that Mick and Fred needed to be taught a lesson, informing them, in no uncertain terms, that I had no intention of raiding the petty cash box a second time and that they should hurry to the sweet shop and purchase the biggest Easter egg they could find at their own expense.

It wasn't until a week or so later when I was draining the moat surrounding the caimans' island that I discovered the identity of the real culprits.

I noticed something sparkling in the mud. I bent down to pick it up and immediately realised that it was the remains of the silver foil which had enveloped the giant Easter egg. It was obvious that Mick and Fred had been wrongly accused now.

Whodunnit? Well, it was one or both of the caimans, wasn't it?

Never in my wildest dreams did I ever imagine that a caiman would eat chocolate but, once again, it just goes to show that, when working with animals, you should always expect the unexpected! ❖

▲ The children were distracting Sarah so one member of their group could steal the large egg.

## Communication

Although strictly speaking deemed to be nocturnal, these little lizards nevertheless remain active during the day. They are surprisingly social, communicating with each other by means of a wide variety of different body language signals and establish a hierarchy of sorts within a given community. This is again an unusual characteristic in the case of lizards.

They can sometimes be aggressive, but generally this is a bluff, and such encounters do not usually result in serious injury. Vocally they will produce a high pitched chirp, which is repeated up to 10 or a dozen times in quick succession.

Individuals will display visually to each other in the form of back arching, or tail wagging. Mourning geckos can be very vocal, making various squeaking noises in order to communicate with one another.

## Disaster! An unexpected theft

However, the noise made by the mourning geckos that I was preparing to transfer to their new quarters that rather soggy Easter Sunday morning was nothing compared to the high-pitched scream that emanated from Sarah just as I was in the process of installing the last of the half a dozen in their new home.

Rushing out to see what all the fuss was about, I found Sarah berating a small gang of older school children who had attempted to duck beneath the barrier surrounding the large Easter egg intent on stealing it away without taking part in the Easter Egg Hunt.

It was all part of a crafty ploy; whilst Sarah was doing her best to keep them out, another member of the group had sneaked up to the table, grabbed the giant Easter egg and was hurtling out of the door of the Reptile House with his ill-gotten gains!

## A rapid rethink

Sarah was beside herself with rage – the Easter Egg Hunt was scheduled to begin in just half an hour's time and now there was no main prize! I had no choice but to raid the petty cash and produce a £10 note for her to be able to rush back to the sweet shop and purchase a replacement.

When she returned, I suggested that, in

order to prevent a repetition of what had happened earlier, there was one place where the prized Easter egg could remain in perfect safety. It would be displayed on the "island" which was surrounded by a fairly deep water moat occupied by the two young South American spectacled caimans (*Caiman crocodilus*) where it would be further protected from the public by a glass screen.

Now, for their own safety, I had decreed that no-one was allowed to cross to the "Caiman island" unless I accompanied them and at any time that I was on holiday, the caimans were fed by means of a long, stout pole, to the end of which was attached a pair of strong pincers. This allowed food to be deposited on the island for the caimans, whilst ensuring that the keepers were in no danger.

## An even greater mystery

It wasn't until about half an hour later that a further scream emanated from Sarah! When I emerged to see what all the fuss was about this time, it did not take me long to figure out what had happened. Mick and Fred were both sporting red faces, which gave me an indication.

Besides, the fact that Fred had just emerged from the cupboard that was used to store the pair of long-handled pincers and other equipment was, as I imagined, evidence in itself of the guilty part that he had played in stealing the replacement Easter egg.

Sarah was quick to insist that I conducted a thorough search of the cupboard, being convinced that, hidden inside, I would discover Mick and Fred's 'prize' concealed here.

The egg wasn't to be found though, although I could not help but imagine that they were still the guilty culprits, having somehow managed to "magically" make the Easter egg disappear.

Technically speaking, they had not acted against my specific instructions by going onto the island unaccompanied, but the fact that the giant Easter egg was nowhere to be seen told its own story.



## Bill's new book

If you want to read more about Bill's time at the Reptile House, don't miss his new digital book entitled *Tales from the Reptile House*, available exclusively online through Amazon. If you are a Kindle Unlimited member, you can even download your copy for free!



The spectacled caimans would deter would-be thieves from taking the new egg.





# Herpetological Mysteries

Could there be a population of unidentified reptile-like creatures living within North America? Dr Karl Shuker investigates, starting off by considering an enigmatic photograph, claimed to portray a dead specimen of this remarkable reptilian mystery beast.

## AMERICA'S MODERN RIVER DINOSAURS

### A very perplexing image!

For many years, sightings of mysterious unidentified reptiles said to resemble small bipedal dinosaurs have been reported from various regions of North America. These encounters have generally been made close to rivers, especially in Colorado and other southwestern states of the USA.

But is there any tangible evidence for the existence of such creatures, which are variously referred to as river dinosaurs, river lizards, and mini-rexes? Then if you assume that they do exist, what could they possibly be?

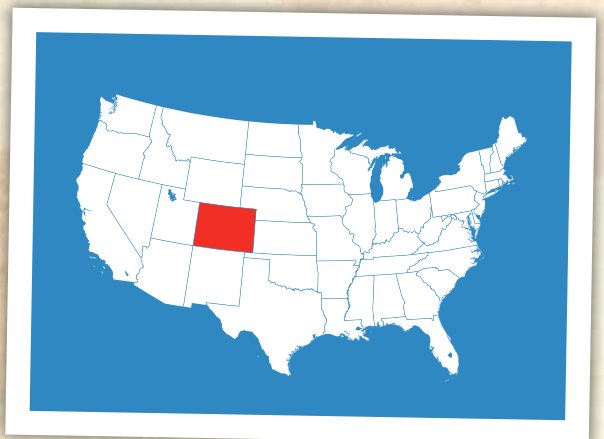
#### Close encounters

One of the most interesting accounts in recent times dates back to the turn of the century. In January 2000, veteran American cryptozoologist Ron Schaffner

was emailed by someone using a generic, non-specific email account, who identified himself simply as 'Derick'. His information was highly intriguing. Derick attracted Ron's interest immediately, as an investigator of animals whose existence is not proven, thanks to his emailed report that contained the following intriguing introductory statement:

"I live in Pueblo, Colorado. I moved out here when I was six and since then I've heard stories of the prairie devil, the pig man and the mini-rex; there's even old Indian legends of evil river demons. You get older and you try not to believe in monsters, however not even the high school kids will have a kegger [outdoor keg beer-drinking teenage parties] down by the river without a raging fire and a lot

➤ There were a number of small, bipedal dinosaurs that used to exist. This is a recently discovered carnivorous species, called *Juravenator*, unearthed in Germany.



▲ The location of the US state, which has been a hotspot for sightings.

◀ The best-documented sighting – or most elaborate hoax? – took place in the vicinity of the US town of Pueblo.

of people [presumably to ensure that 'monsters' keep well away]. It's not like people don't see things, people see them, but they just don't make a big deal of it. If you live by the river like me, you just get used to it."

Following that enticing preamble, Derick went on to describe his encounter with what appears to have been one of this region's mysterious 'mini-rexes'. He claimed that while he and a friend were riding the latter's dirt bike close to the Fountain River near Pueblo one day in







▲ The rocky shoreline of the Arkansas River near Pueblo, Colorado. Documented sightings are relatively common close to rivers in this part of the USA.

July 1998, they suddenly saw a truly extraordinary bipedal creature run across the clearing in front of them:

"It was three to four feet long, greenish with black markings on its back, and a yellowish-orange under belly. It walked on its hind legs, never dragging its tail, its front limbs (I call them limbs because they were more like arms than anything) were smaller in comparison to the back ones and it had four or three claws/fingers. I'm not sure for it was seen at a great distance. It also had some kind of lump or horn over each eye. When it noticed our presence, it let out a high pitched screech or some sort of bird chirping, that pierced my ears, and then took off."

### On the trail

The pair dashed to Derick's house to fetch a camera. They then returned to the location of their encounter and photographed the creature's three-toed, 5cm (2in) diameter tracks (with a *Marlboro Red* cigarette placed alongside them in some photos for the purposes of scale).

Derick also stated that he subsequently heard of other sightings, and discovered that a friend had actually photographed one such creature. Following some

persuasion, the latter friend allowed Derick to send scans of those photos, together with his own track photos, plus a sighting account dating back to 1998, to Ron.

He in turn showed them to Chad Arment, a fellow American cryptozoologist who has a particular interest in American mystery reptiles. However, as the photos revealed little in the way of detail, even when magnified, Ron and Chad agreed that their subjects could easily be dinosaur models.



▲ The head of the mysterious creature in the photograph is similar to that of the dinosaur called *Compsognathus*. Bear in mind that we simply don't know the colouration of dinosaurs with certainty, nor if they displayed superficial skin projections as shown in this reconstruction, so superficial differences in appearance are not significant.

Nevertheless, Chad remained sufficiently intrigued to email Derick and state that if such beasts were indeed real, better evidence would be needed in order to confirm this. He didn't expect to receive a reply, but in April 2000, he received an email enclosing two scans of the truly remarkable photograph reproduced here in this present article of mine.

Referring to the creature in this photo as a 'river lizard' (but which is presumably the same type as the mini-rex that he saw), Derick stated that it had taken him some time to obtain scans of the photo.

Also, he didn't know when or specifically where the photos had been taken in the first place - only "somewhere" in Colorado.

As the creature does not resemble any species currently recognised by science, Chad later attempted to email Derick for further details. He then received an automated reply stating that Derick's email address was no longer in operation, and unfortunately, he has never heard from him again.

### Other lines of investigation

However, Chad has learnt from another source that the term 'river dinosaur' has apparently been used in relation to such creatures. Furthermore, an individual who had previously collected Colorado reptiles for some of Chad's friends working in the pet trade then offered to capture some 'river dinosaurs' (whose

➤ The alleged dead specimen of the Colorado River dinosaur being held. (Man in the photograph and copyright holder unknown).



◀ Off-road dirt bike riding led to the pair spotting the mysterious creature.





Could a photo-manipulated monitor lizard play a part in the identity of this mysterious creature?

description compared closely with the appearance of the 'river lizard' in Derick's photo). Unfortunately, this exciting offer had to be declined due to lack of funds.

The 'river lizard' photograph supplied by Derick has been floating around online for a long time now, and has attracted much attention and numerous comments on the many websites where it has appeared during this period. The consensus seems to be that it is a hoax, but this has never been confirmed.

In addition, I have conducted several Google-image searches, concentrating variously upon the whole image, the section of it featuring the person, the part that features the creature and the like, but all to no avail. However, it certainly contains some anomalous details, especially in relation to the creature's appearance, as commented upon by Chad in an account of this and other bipedal 'dinosaur' sightings reported from the USA that was published in the *North American Biofortean Review* periodical (vol. 2, #2, 2000).

### More anomalies

For example: if the 'river lizard' had only recently been shot when this photograph was taken, and considering that recently-dead reptiles are normally very



limp, and also bearing in mind that it was being held vertically, why is its tail curving inward rather than simply hanging straight down?

And why is its mouth gaping open rather than being held closed, or at least nearly so, as one would expect under the above-listed conditions? As Chad also pointed out, very convincing life-like rubber models of dinosaurs can be made or readily obtained nowadays, so we cannot be sure that the 'river lizard' in the photo was ever a living entity anyway.

And even if it was once alive, thanks to the photo-manipulation software that was already available back in 2000, there is no certainty that this creature's appearance hasn't been profoundly modified digitally from whatever it was originally. Moreover, the entire photograph might conceivably be a cleverly constructed montage. There could be an original photo of a person holding a gun for example, into which a second, digitally manipulated photo of some animal has been deftly incorporated.

### A personal assessment

Certainly, whenever I've looked at it, I've been struck by just how very odd, how very unnatural this image in this photo seems to be, and I don't just mean the bizarre appearance of the 'river lizard' itself but the whole image. Even the person's face is so obscured by the shadow of their hat that I'm not exactly

A range of life-like model dinosaurs now exist, being created with relative ease, making things much easier for would-be hoaxers.





Certainly, there might appear to be similarities in the shape of the head between the creature in the photo and a living monitor lizard (*Varanus* species).



◀ There seem unexpected similarities between the anatomy of the creature's hind limbs and the segmented limbs of arthropods.

certain whether they are male or female. But as far as the 'river lizard' itself is concerned: having spent a lifetime observing animals in photos and in the living state, at the risk of being accused of sounding unscientific and overly reliant upon gut instinct, it just doesn't look 'right' to me.

In particular, the incongruous hind limbs sported by this creature seem entirely out of place on its body. The curiously flat, disproportionately large and flared, oddly triangular (rather than oval) haunches look not only unrealistic but also as if they have been crudely glued (or photo-applied) there, rather than being a natural feature of its anatomy.

When viewed in magnified form, the lower portion of each of these hind limbs seems to be segmented, rather like that of an arthropod invertebrate. These features are very strange indeed. Also worrying is the artificial appearance of the creature's open mouth, almost as if the lower jaw has been manually added – and who knows, perhaps it has been!

### Is it a hoax?

I therefore consider it plausible that this 'river lizard' photo is indeed a hoax. My line of thought is that the mystifying creature portrayed here constitutes some form of manufactured composite (either physical or photo-manipulated), such as a much-modified dead monitor lizard, a sub-adult crocodile, or even a dinosaur

model, for instance.

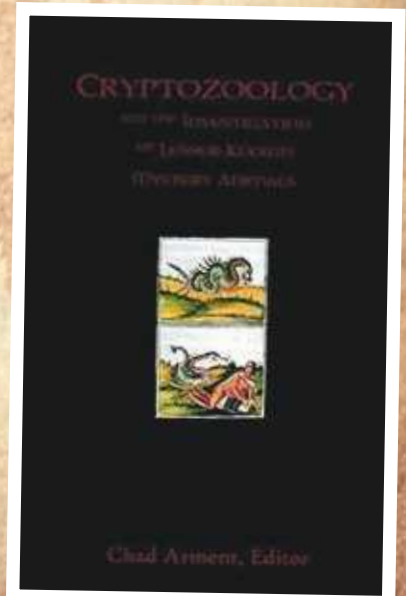
Moreover, if my reasoning so far is correct, then I further suggest that the creature's bizarre-looking hind limbs as seen in the photo are fake; that they have been seemingly less than skilfully attached to (or superimposed upon) its body. They presumably replace whatever hind limbs it may have originally possessed, with the substitution having been carried out to enhance even further the contrived exotic, unfamiliar appearance of this composite creature, to make the photo more dramatic.

Having said all of that, however, this is nothing more than speculation on my part, and I am well aware that I could be entirely wrong, with the 'river lizard' potentially being a *bona fide* cryptid carcass after all. If so, I would be only too happy to be proved wrong! Hence I would be most interested to receive any comments, views, or additional information concerning this mystery from readers. These can be emailed to me c/o the editor (prk.ed@kelsey.co.uk).

**Many similar accounts**

One American cryptozoologist who has investigated this and other such cryptids with particular zeal and success since 2001 is Nick Sucik. He duly published his very thought-provoking findings in a chapter devoted to 'river dinosaurs'/mini-rexes in a most interesting compendium edited by Chad Arment and entitled *Cryptozoology and the Investigation of Lesser-Known Mystery Animals* (2006). As will soon be discovered when reading Nick's chapter, a fair number of roughly consistent cases have been documented from a range of U.S.A. localities over the years, but with particular frequency across Colorado, leaving aside Derick's photograph.

The size of such beasts may differ, as may eyewitness recollections of colouration, but by and large, the same image of a miniature bipedal dinosaurian creature with sturdy hind legs, much



► Chad Arment's book *Cryptozoology and the Investigation of Lesser-Known Mystery Animals*, published by Coachwhip Publishing, contains more details of sightings of mini-rexes.





smaller, delicate forelegs, a long study tail, small but very sharp teeth, and bare skin crops up time and again. Eyewitnesses frequently compare what they have seen to certain fossil theropods (at least in basic outline), including *T. rex* and *Compsognathus* (the latter small theropod being very comparable in size to most of the mini-rex specimens reported).

### A convincing example

Nick's chapter contains far too many cases and far too much information to review comprehensively here, but I found several cases to be especially interesting. His chapter opens with a detailed account of a mini-rex sighting that occurred one warm July evening in 2000 as three women of successive generations were driving along a country road near the rural community of

▲ The landscape of Cortez, Colorado where the sighting occurred in front of three eyewitnesses.

▼ The women's sighting is equally unlikely to be that of a mammal such as a wallaby. In spite of their upright posture, these mammals hop and jump, rather than run. Photo courtesy of the author.

Yellow Jacket, 24km (15ml) north of Cortez, Colorado.

The creature entered their headlights from the side, and the driver braked, thinking that it was a fawn. When the headlights lit it up, however, its two astonished eyewitnesses in the front of the vehicle realised that it was something very different indeed from any deer. Based on their observations, Nick described it as follows in his book:

"Its body appeared smooth, devoid of fur or feathers. Its height perhaps was three feet and the small head was bent downward on a slender neck. The creature ran on two skinny legs with its tiny forelimbs held out in front of its body as it ran. Its body tapered down into a lengthy tail that, combined with the head and neck, made it about 5 feet long. The movement of the animal was noted as graceful, the head not bouncing as it ran."

### An instant assessment

The animal quickly passed in front of them and disappeared into the darkness. Its eyewitnesses were shocked by what they had seen, but after they had regained their composure, one of them joked that it must have escaped from some local Jurassic Park.

Although a light-hearted remark, it is nonetheless telling, because it serves very well to underline just how very dinosaurian the creature must have appeared to them – as opposed to rather more mundane alternatives, such as an exotic escapee from captivity, like a wallaby, but which is furry and jumps,



▲ Descriptions suggest that this mysterious creature looks not dissimilar to the dinosaurs called *Compsognathus*. Photo courtesy of the author.

not runs; or a rhea or emu, which do run on two feet, but are obviously feathered.

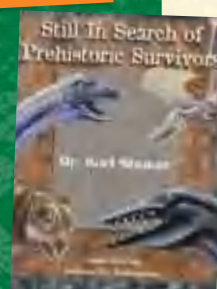
\* Dr Karl Shuker BSc PhD FRES FZS is a zoologist, author and broadcaster who is pre-eminent in the field of cryptozoology – the study of animals whose existence is not proven.

### Next time

In the concluding part of this article next month, Karl reviews a number of other fascinating 'river dinosaur' / mini-rex sightings, and considers whether any of them could in reality be based upon reptilian forms already known to science.


## Karl's new book

Karl's forthcoming book, entitled *Still In Search of Prehistoric Survivors*, is being published later this year.



▲ It seems pretty clear that the creature seen by the women could not have been a large, flightless bird such as a rhea. Photo courtesy of the author.





# Puzzle Corner

Find the solutions to these puzzles by following the clues, to discover which reptiles, amphibians or invertebrates are hidden within them. The answers can be found on p66.

## WHERE IN THE WORLD?

On which island are these species to be found, and what are they? Two species are not native to the island – but can you spot them?



## Amphibian ID



Can you identify this amphibian, and where in the world does it originate?

**BEST OF CIRCLES**

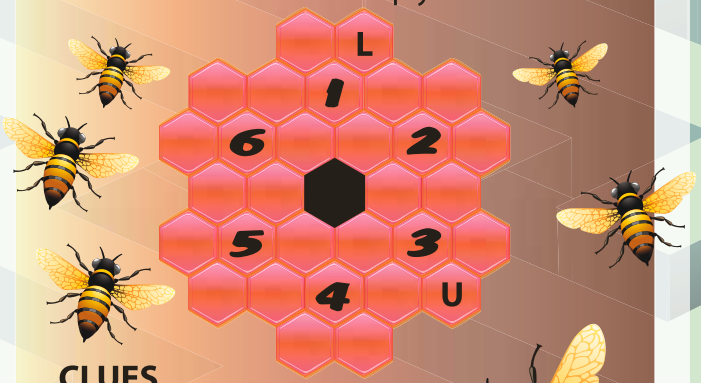
As indicated by the code below, each star card in the circle stands for either of two letters of the alphabet – though not necessarily the same one each time. Read around the ring to reveal the name (6,9) of a lizard native in particular to Yemen.

The name reads clockwise but we don't tell you where it begins.

A 2 3 4 5 6 7 8 9 10 J Q K  
A-B C-D E-F G-H I-J K-L M-N O-P Q-R S-T U-V W-X Y-Z

## HONEYCOMB

Enter the six-letter solutions to the clues **CLOCKWISE** around the appropriate numbers of the grid so that they all interlock, producing the name of a fictional snake around the black centre. Two letters have been entered to help you start.



### CLUES

- 1 Have a flutter
- 2 Homing bird
- 3 Root vegetable
- 4 Dried grape
- 5 Lawn court sport
- 6 --- Bates, *Psycho* killer





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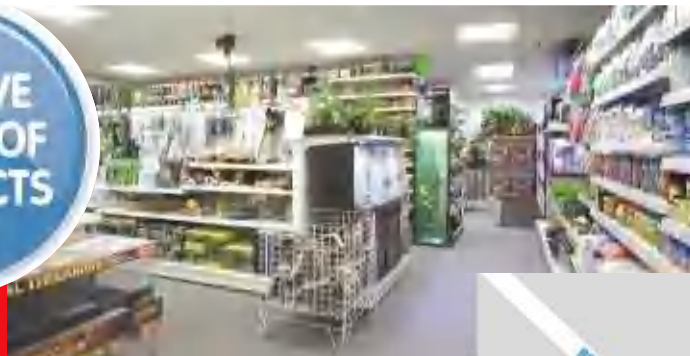
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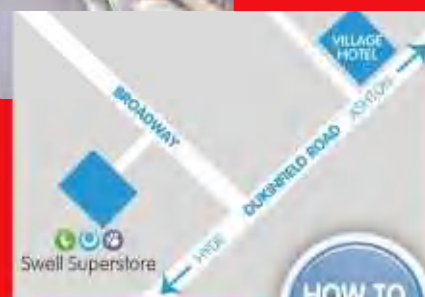
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# YOU & YOUR Reptiles

**WIN**

If you have a favourite photograph of one of your reptiles, amphibians or invertebrates which you'd like to see included in the magazine, then email us a **high resolution** digital image to [prk.ed@kelsey.co.uk](mailto:prk.ed@kelsey.co.uk). Please include details about the subject, confirm anyone in the picture is happy for it to be published and that you took it.

This month's winner will be able to try the new 100g EarthPro-A supplement, just released by Arcadia. It is a potent dietary supplement that will help to supply all of the vitamins and essential minerals that are required by exotics in collections, in a safe and natural way. Both potent carotenoids to improve colouration naturally, as well as bee pollen are included, but there are no synthetics which can be easily over- or under-dosed.



▲ A stunning yellow crested Jackson's chameleon (*Triceros jacksoni xantholophus*) called Khaos. Sent in by Jayde from Stoke-on-Trent.



A two year old Sorong green tree python called Merlina, who lives with Ben and Tanya in Wymondham, Norfolk

► A knight or Cuban anole, sent in by John.



Kobe, a rescued bearded dragon who lives with his new owner Serena in Derby.



Slash - a ball (royal) python. Sent in by Pete from Peterborough.



Two false tomato frogs (*Dyscophus guineti*), photographed by John.





A red-eyed tree frog called Paulo, sent in by owner Henry.

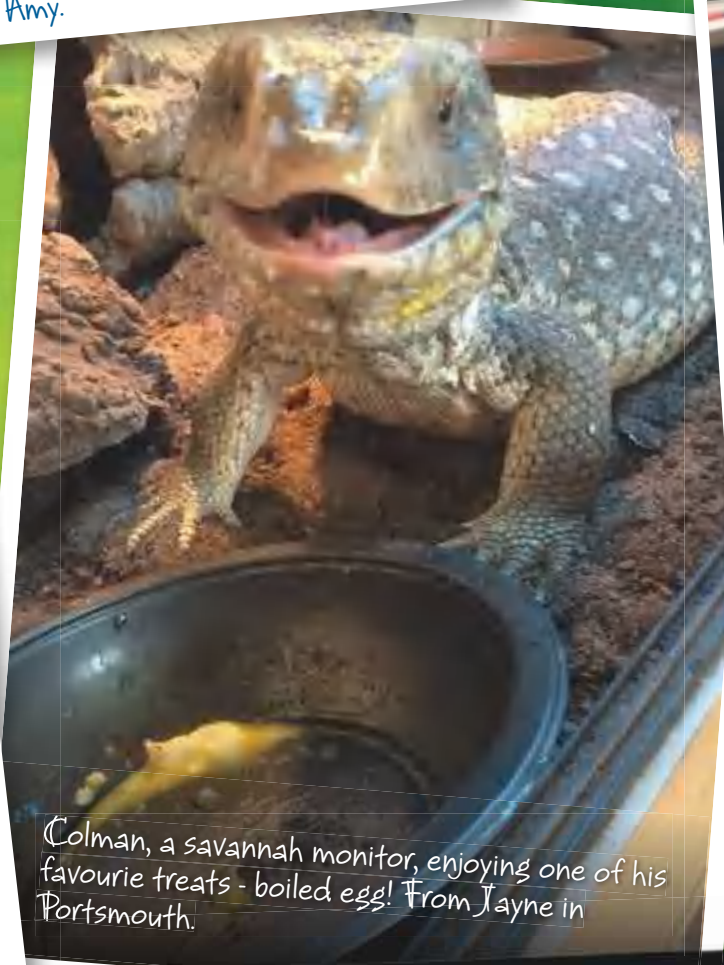


A picture of my six year old son Isaac with his adorable crested gecko Vader. From Amy.

Kerry, a carpet python exploring her new home. She is two years old, and 1.5m (5ft) long. From Pete and Jess in Hereford.



A trio of glass lizards, sent in by Luke.



Colman, a savannah monitor, enjoying one of his favourite treats - boiled egg! From Jayne in Portsmouth.



An eyed lizard. From John in Horsham, West Sussex.

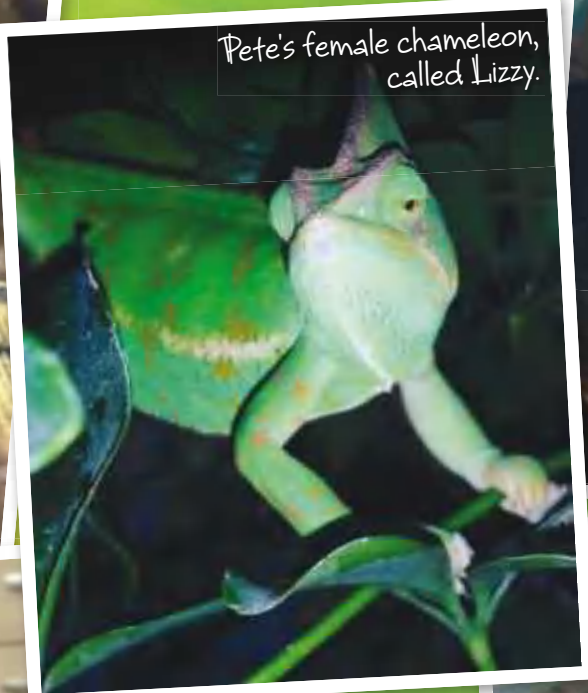


Bodie, a common boa who is now seven years old. From Luke.



CC the corn snake. From Lea in Peterborough.





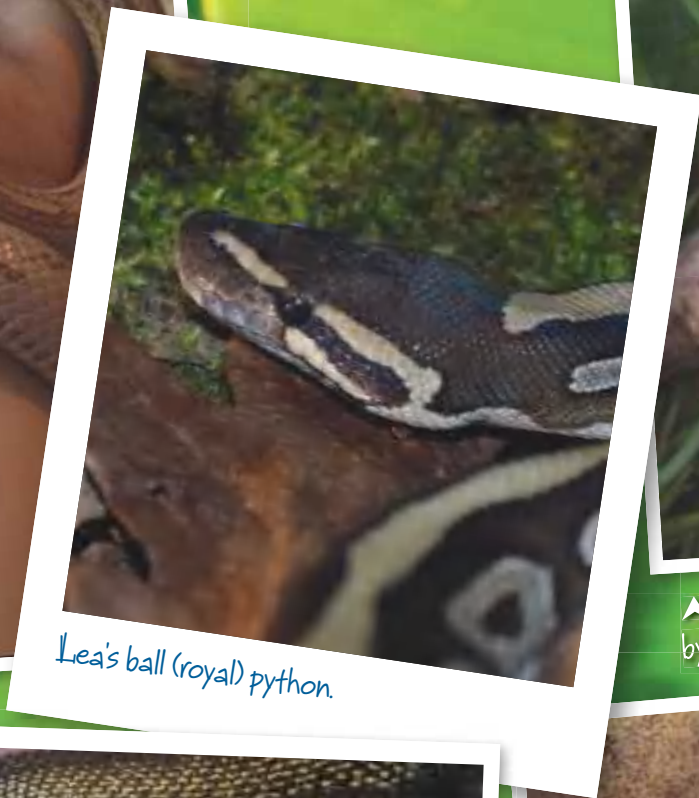
Pete's female chameleon, called Lizzy.



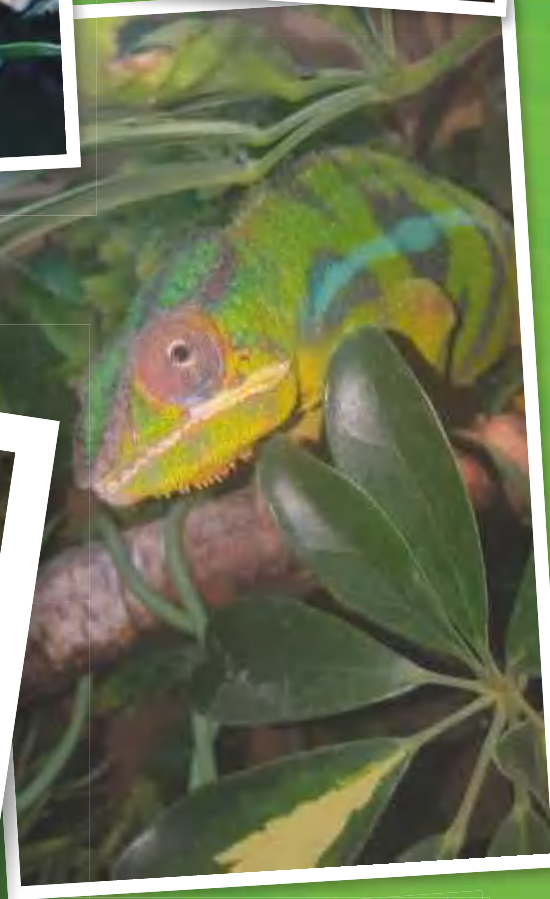
Fred the bearded dragon who lives with Tegan in Lincolnshire.



◀ Bubbles the corn snake. From Laura in Lancing, West Sussex.



Lea's ball (royal) python.



▲ Vai, a panther chameleon, sent in by Lea in Peterborough.



Priscilla the desert king snake. Sent in by Luke.



Rough-scaled sand boa. From Luke in Towcester, Northamptonshire.





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Photo courtesy Paul Gordon.

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\*These are just some of the features planned for the next issue but circumstances outside our control may force last-minute changes. If this happens, we will substitute items of equal or greater interest.

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### WHERE IN THE WORLD?



THESE SPECIES ARE ALL TO BE FOUND ON THE CARIBBEAN ISLAND OF JAMAICA. THEY ARE AS FOLLOWS, WITH THE INTRODUCED SPECIES BEING THE TROPICAL HOUSE GECKO AND THE CUBAN FLAT-HEAD FROG:

- 1 JAMAICAN ANOLE (*ANOLIS GRAHAMI*).
- 2 JAMAICAN BOA (*EPICRATES SUBFLAVUS*).
- 3 TROPICAL HOUSE GECKO (*HEMIDACTYLUS MABOUIA*).
- 4 CUBAN FLAT-HEAD FROG (*ELEUTHERODACTYLUS PLANIROSTRIS*).
- 5 JAMAICAN IGUANA (*CYCLURA COLLEI*).
- 6 JAMAICAN GIANT ANOLE (*ANOLIS GARMANI*).

### AMPHIBIAN ID

THIS IS THE LONG-NOSED OR MALAYAN HORNED FROG (*MEGOPHYRUS NASUTA*), WHICH IS DISTRIBUTED IN RAINFOREST AREAS OF SOUTH-EAST ASIA. ITS RANGE EXTENDS FROM PENINSULA MALAYA TO PARTS OF SINGAPORE, SUMATRA AND BORNEO. REPORTS OF THIS PARTICULAR FROG FROM SOUTHERN THAILAND MAY, HOWEVER, REFER TO ANOTHER SIMILAR BUT SEPARATE SPECIES.

### HONEYCOMB

- 1 GAMBLE,
- 2 PIGEON,
- 3 TURNIP,
- 4 RAISIN,
- 5 TENNIS,
- 6 NORMAN.

**CENTRAL WORD:** NAGINI, VOLDEMORT'S SNAKE IN THE HARRY POTTER SERIES

### BEST OF CIRCLES

VEILED CHAMELEON, STARTING AT THE JACK.

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An effective formulation for supporting intestinal health during periods of challenge

Available from your  
local pet and country  
retailer or online



Equine



Smallholder  
Animals



Pets



Avian

Please call us or check our website for your nearest stockist [www.verm-x.com](http://www.verm-x.com) +44 (0)870 850 2313 [sales@verm-x.com](mailto:sales@verm-x.com)

Paddocks Farm Partnership Ltd, Somerset, TA4 2HQ UK



# GOURMET



**AQUATIC  
TURTLE FOOD**  
Aquatic Turtle  
Pellets, Dried  
Shrimp,  
Mealworms,  
and whole  
Cranberries



**BEARDED  
DRAGON FOOD**  
Dried Mealworms,  
Blueberries, and  
Dried Rose  
Flower Petals



**BOX  
TURTLE FOOD**  
Box Turtle  
Food, Dried  
Mealworms,  
Mushrooms,  
and Strawberries



Your reptiles know what high quality food is when they taste it, so why not give them what they want? Zoo Med's Gourmet reptile foods contain fresh ingredients that were specifically selected for their supreme nutritional value, but also for their amazing taste.

Visit our website below for more information regarding our Gourmet Foods and other fine Zoo Med products.

[WWW.ZOOMED.EU](http://WWW.ZOOMED.EU)

